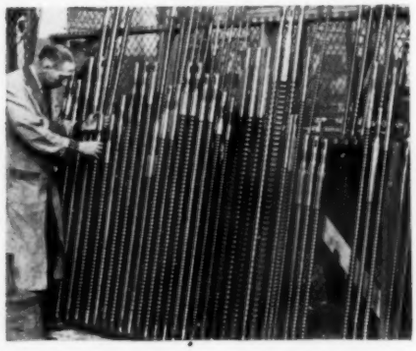
# AMERICAN MACHINIST

*January* 8, 1941



**All in a Row**—*A line on tool maintenance is essential for best results in broaching*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## MAJOR ARTICLES


The Care of Broaching Tools ..... 1
Torch-Made Tanks ..... 4
We Need Foremen ..... *A. H. Timmerman* 6
Drawn Shapes ..... *J. T. Weinzierl and A. C. Heintz* 8


## ARMAMENT SECTION


Rear Sights for Browning Guns ..... *Allen G. Burdett* 16
Jobs for Those Idle Machines ..... 25


## IDEAS FROM PRACTICAL MEN

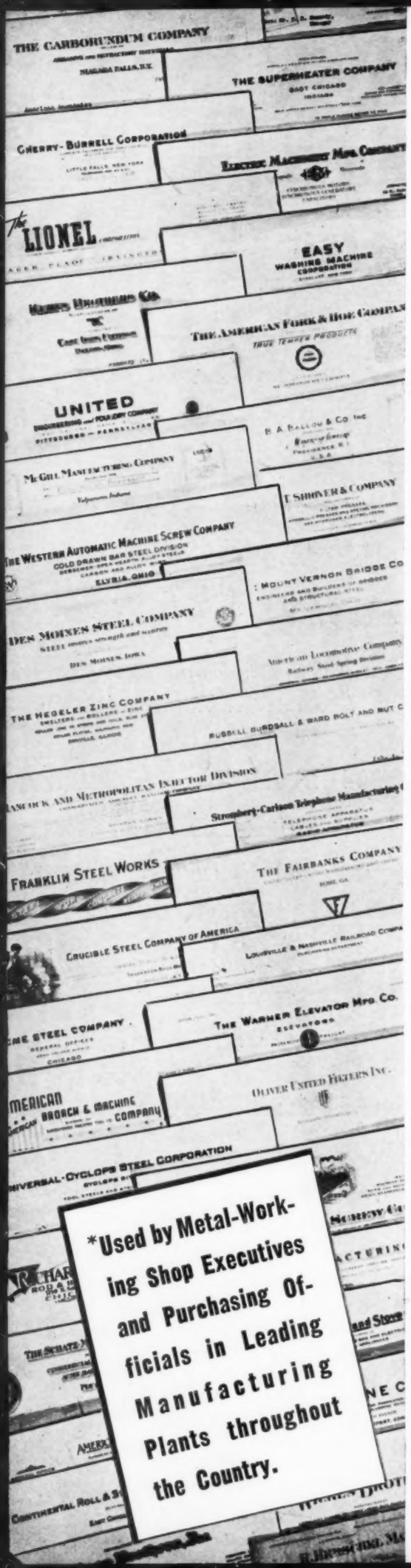

Niched Boring Bar Does Chatter ..... *Arthur Silvester* 12
Cam-Operated Tool Cuts Thin Stock ..... *Douglas Turner* 12
Accurate Washers from Thin Material ..... *S. Arthur* 13
A T-Wrench Tap Extension ..... *Robert S. Alexander* 13
Welding Kinks for the Locomotive Shop .... *A. H. Carroll* 13
Stock Diameter for Cutting Threads ..... *H. R. Fowler* 14
Grooves Speed Cutting of Rings ..... *V. V. Roberson* 14


## NEWS OF THE INDUSTRY


Gaging Business ..... 30b
Watching Washington 30i
Inside Detroit ..... 30g
Names in the News. 30k
Plant Expansion .... 30k
Obituaries ..... 30l


## DEPARTMENTS


What's in This Issue 41 adv.
Reference Book Sheet 27
Shop Equipment News 31
New Materials ..... 42
Editorial ..... 30a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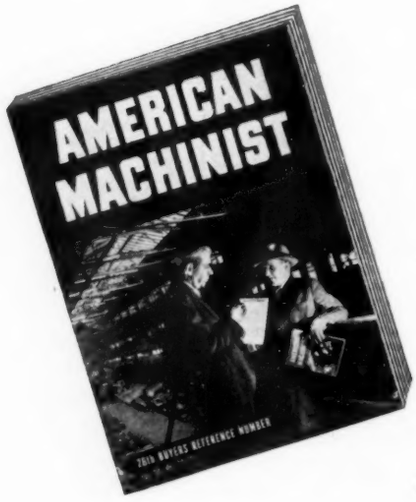
## Metal-Working's

# Standard Buying Reference

## For Year-Round Use*




Your next copy of American Machinist—to be in the mail in two weeks—will be specifically designed to serve as your buying reference throughout 1941. Both editorial and advertising pages will help you whenever you're in the market for equipment, parts, supplies, or services. They will merit thorough study. Eight big sections will be classified to facilitate quick reference. Look for this feature issue. Hold it for year-round use!

*Coming* — **January 22**

# WHAT'S IN THIS ISSUE

**SIGHT**

One of the most important assemblies to go into Browning machine guns is the rear sight, a tricky little device which compensates for range, wind, etc., etc. Parts for this sight, which is of fairly simple construction are innocent enough looking, but require quite a few operations to close tolerances. They are being made by a New Jersey tool and die shop, The Service Machine Company, a manufacturer whose methods are not on the confidential list. These methods are both efficient and interesting, so we thought you'd like to see them in some detail. So on page 16, in the Armament Section, we take you into a certain metal-working establishment "somewhere in Jersey" for an inside look at the manufacture of rear sights for Browning guns.

**LOOKING FOR WORK?**

Every so often some one will drop into the office to inquire how he can get some government work or do subcontracting on defense orders. As it usually turns out, he has a small job shop, and in spite of all the current defense activity he's not running at capacity. The trouble often is that he doesn't know how to go about contacting the proper people. Naturally, we're only too glad to help all we can, but it occurred to us that there are probably thousands of owners of small shops throughout the country who may be in the same situation. So for the benefit of shop owners with an idle machine or two, who would like to do their part in the present emergency, we've compiled the article on page 25 of the Armament Section. It explains government procedure and gives names, addresses and titles of persons to contact.

**BIGGER AND BETTER**

This time it's huge cylindrical assemblies. These, it seems, can be made bigger and better with the Unionmelt process—especially when aided and abetted by special equipment to ease the handling of the cumbersome shapes. Such equipment is quite simple, yet it makes possible convenient fabrication of sections as long as can be transported by rail. The set-up developed by Allis-Chalmers, and its underlying principles, are outlined on page 4.

**BEST BROACHES**

. . . are sharp broaches. Since their life is apt to be shorter than for other cutting tools, anything which will increase it is of vital importance. One of these, paradoxically enough, is frequent grinding. It's like filling a tooth when the cavity's still small. But many other factors affect broach performance as well. They're discussed in the first article of this first issue of the year 1941, which begins, appropriately enough, on page 1. The material was collected by R. R. Wiese, our western editor, who, we feel, deserves a hearty round of applause.

**DEEPER DRAWS**

Now that you're well into the series on cold working of aluminum, we hope you have only to be told that this issue's installment is on page 8 in order for you to begin thumbing the pages frantically. In case this meager information isn't enough, we might add that this article concerns the technique of drawing, with special emphasis on what—and what not—to do for best results. Backed by the accumulated experience of the Aluminum Company of America, the authors of the first installment—Dr. L. J. Weber and J. T. Weinzierl—have crammed plenty of data in this one, too.

J. T. WEINZIERL
and DR. L. J. WEBER
*. . . deeper draws for defense*

**FOREMEN TO THE FORE**

We have often referred in these columns to the importance of foremen. In an expanding industry it assumes a broader aspect. For when their job boils down to getting plenty of production, in spite of everything, it develops there aren't enough really good foremen to go around. The answer, of course, is training. On page 6 you'll find many helpful suggestions for whatever training system you're planning. The article is written by A. H. Timmerman, vice-president of Wagner Electric Corporation and president of the National Metal Trades Association, whose long experience with the problem should prove of great value to all plant managements who are confronted with it now.

A. H. TIMMERMAN
*. . . for efficient foremen*

## COMING

Despite air raids, we understand, everything in England still stops for tea. Emulating the heroic British, we of AMERICAN MACHINIST will stop virtually everything—Armament Sections, aluminum series, etc.—to bring you information on the newest in metal-working equipment. We refer to the 28th Annual Buyers Reference Number, which will appear January 22. In it will be reviewed over a thousand items of new and improved equipment and supplies which were made available in 1940. In these times of tremendous plant expansion for defense, with all sorts of equipment at a premium, it will be a number which you'll look forward to saving and consulting all through 1941. Over a hundred illustration-jammed pages in the January 22 AMERICAN MACHINIST!

# MAKING BETTER MACHINE TOOLS
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Cincinnati Hypro Planer handling highly productive work for a well known machine tool builder.

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Cincinnati Hypro Planer Miller performing another operation on machine tool bed.

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ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

*Universal tool and cutter grinders are commonly used for sharpening broaches. The fixture holds a keyway broach for grinding the hook angle*

# The Care of Broaching Tools

**No broaching operation can be successful unless the broach is kept in good condition. Here are some pointers that will help keep these tools in good shape**

LIKE ALL cutting tools, broaches require care in handling and frequent sharpening in order to obtain the maximum production per tool. Better accuracy and finish will be obtained in the parts if due regard is given to their proper care.

At best, broaches are not up to other cutting tools when measured in hours of cutting life. Since their chief advantage lies in rapidly producing a great number of parts, maximum operating efficiency should be interpreted in terms of economic tool life.

A broach should never be permitted to run in a dull condition. More damage can occur to a dull broach on a few parts, than on hundreds of parts while sharp, as the additional friction will wear the teeth excessively and cause the teeth to become undersized or grooved.

When a broach has become dull, a great deal of stock must be ground from the front edge of the tooth. This stock would have permitted several light grinds, resulting in more productivity, better parts, less power consumed and a better condition of the broach.

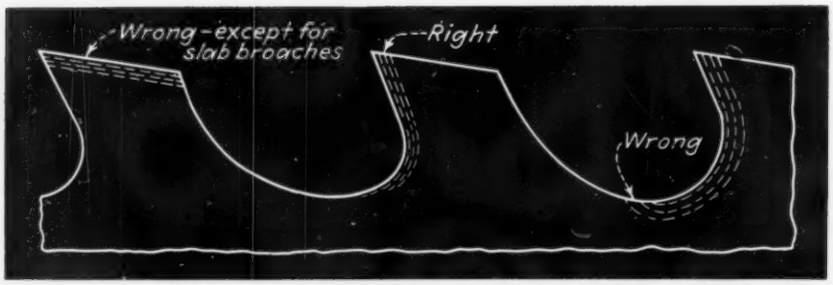
It is always well to examine a broach before putting it in service to see that the teeth are not nicked. If nicks are found, they should be removed; otherwise a groove may be worn through the tooth at the point where the nick is located. This may cause the broach to "drift" so that the broached hole is offcenter with the rough machined hole.

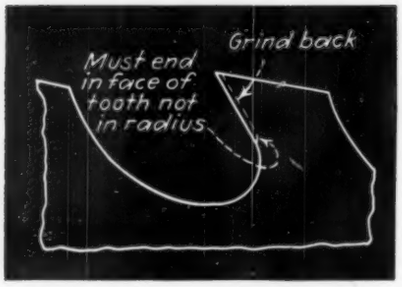
Tooth shape and smoothness of tooth face should be maintained carefully. At no time should wear be permitted to exceed 0.005 in. before resharpening. Coring broaches may be an exception because of their wide lands. When broaches are resharpened the original form of tooth should be maintained.

The amount of hook used will depend to a certain extent on the ability to get a wheel in position to do the job. Only small wheels can be used to get the higher angles on small diameter round broaches. This increases the amount of time required to grind the broach. Every shop must determine its own compromise between sharpening efficiency and cutting efficiency.

Hook angles increase with the ductility of the material. Some approximate values used are:

| | |
|---|---|
| Cast iron | 6 to 8 deg. |
| Hard steel | about 10 deg. |




*Right and wrong methods of sharpening most broaches are indicated here. Only in the case of slab broaches is it permissible to resharpen by grinding down the top*

*Sometimes a tooth ground in this manner serves to break up the chips and prevent them from jamming. This method can be used for heavy cuts or ductile materials*

Soft steel..... about 15 deg.
Aluminum ..... 15 deg. or more
Brittle brasses and bronzes ..... —5 to 0 deg.

In sharpening a broach the wheel should be dressed and presented so as to retain the original hook angle and fillet in the bottom of the tooth. The chip space should not be increased in depth, as any undercut below the original form may cause the chips to clog.

Round broaches should be resharpened by grinding back the face. It is necessary to swivel the wheel at a considerably greater angle than the hook angle of the tooth. Otherwise, the side of the wheel generates the front face of the tooth into a plane square with the axis. Regrinding the top of the teeth changes the dimensions of the hole broached, and should not be done. Generally, the top rake is 1½ to 2 deg. to keep the broach from drifting. A top rake of 1½ deg. may be used on roughing teeth on a round broach, and ½ to 1 deg. for the finishing teeth. Spline broaches usually run 3 deg. on roughing teeth and 1½ deg. on finishing teeth. Some companies use a rake angle which varies from 2 deg. at the beginning to ½ deg. at the end of the broach.

Slab or surface broaches are resharpened by grinding down the top rake. This angle may be as much as 3½ deg., because the broach and teeth usually are held securely in position so that there is no drifting. By occasionally supplementing top rake grinding with regrinding of the hook, it is possible to get a long life from surface broaches.

A smooth blending of the hook angle with the rest of the tooth form is needed to get best flow of chips. If the root radius is not smooth, the chips will stick, cause the teeth to load and break unless cleaned out. If the face is rough, the cutting edge will break down much sooner.

Blending and smoothness of surface can be controlled by using a proper grinding wheel. A fine grain wheel will give a smooth face. Recommendations on wheels vary. Usually aluminum oxide abrasives are used in a soft or medium grade vitrified wheel. The face usually is ground with a disk wheel having from 46- to 80-grain size. Manufacturers of broaches often use 100-grain wheels for final polishing of the face. Where extremely fine finish is required on the work, wheels as fine as 400-grain size have been used. Rake usually is ground with a straight cup, aluminum oxide abrasive, 60-grain, vitrified bond wheel.

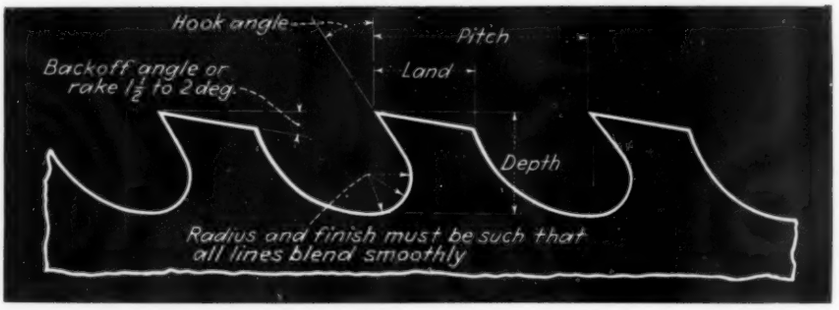
Since the grinding wheel has a generating effect on round broaches, it is desirable to use a round tip on the wheel so that the markings are reduced. Care must be exercised in grinding so that the edge is not burned. After the face has been ground back the required amount to compensate for wear, it is desirable to let the wheel "run out" instead of stopping it quickly.

One common fault in broach grinding is that of grinding different amounts from each tooth. It is better to find the maximum wear on the teeth and then grind all of them back the same amount. This is particularly important for broaches which have a small taper and those where the percentage of change would be large. If the broach is so large that the percentage change on any one tooth would be small, the individual teeth can be ground to suit the wear on each tooth.

Factors which should be watched in grinding broaches include:

1. Bearings should be tight so that there is no end play in the spindle,

## DIMENSIONS FOR ROUND AND SPLINE BROACHES




| Cut Length (Inches) | Pitch (Inches) | Land (Inches) | Depth (Inches) | Radius (Inches) |
|---|---|---|---|---|
| 3/16 | 1/8 | 3/64 | 3/64 | 1/32 |
| 1/4 | 3/16 | 1/16 | 1/16 | 1/32 |
| 3/8 | 7/32 | 1/16 | 5/64 | 3/64 |
| 1/2 | 1/4 | 1/16 | 3/32 | 1/16 |
| 3/4 | 5/16 | 3/32 | 1/8 | 5/64 |
| 1 | 11/32 | 3/32 | 1/8 | 5/64 |
| 1 1/8 | 3/8 | 7/64 | 9/64 | 3/32 |
| 1 1/4 to 1 5/8 | 7/16 | 1/8 | 5/32 | 7/64 |
| 1 3/4 to 2 | 1/2 | 1/8 | 3/16 | 1/8 |
| 2 1/4 to 2 1/2 | 9/16 | 9/64 | 7/32 | 9/64 |
| 2 3/4 to 3 1/4 | 5/8 | 5/32 | 15/64 | 5/32 |
| 3 1/2 to 4 | 11/16 | 5/32 | 9/32 | 3/16 |
| 4 1/4 to 4 3/4 | 3/4 | 5/32 | 19/64 | 3/16 |
| 5 to 5 1/2 | 13/16 | 5/32 | 5/16 | 13/64 |
| 5 3/4 to 6 | 7/8 | 3/16 | 11/32 | 7/32 |
| 6 1/2 to 7 | 15/16 | 3/16 | 23/64 | 7/32 |
| 7 1/2 to 8 | 1 | 7/32 | 3/8 | 1/4 |
| 8 1/2 to 10 1/2 | 1 1/8 | 1/4 | 25/64 | 1/4 |
| 11 to 12 | 1 1/4 | 9/32 | 13/32 | 7/64 |

otherwise the broach face will not be finished smoothly. Spindles should be of sufficient diameter so that deflection under grinding load will be kept at a minimum.

2. Wheels should be in balance.

3. Wheels should not be too hard. The use of medium soft wheels which can be used on high-speed steels without burning is recommended. Hard wheels overload the grinding spindle, causing it to spring away from the work.

4. Grain should not be coarse. A 46-grain finish generally is acceptable and produces a good cutting edge. Finer grain wheels will give a better finish, but will reduce allowable depth of cut.

5. It is not desirable to plunge out the clearance rake on the periphery of a straight wheel, unless the grinding wheel is dressed for every tooth and a different portion of the wheel is used for each tooth. A cup wheel is preferred on slab broaches.

6. Whenever the face of a surface broach is made up of more than one segment, inspect the sections in the broach bar before they leave the grinder to make sure that the teeth blend and that one tooth is not ahead or behind the other, or that the chip clearance at the point where the two sections meet is not stepped. These are traps for chips which not only affect the finish, but eventually may cause the teeth to fail.

7. Every broaching tooth should be inspected separately because each is an individual cutter and one bad tooth may cause considerable damage.

8. When the lands are being reground, as in a slab broach, it is desirable to measure tooth height carefully. If the rise is too abrupt, the tooth will cut more material than the space available for holding chips. One broach grinder automatically measures and grinds to the proper dimension. It may be necessary to regrind the depth of the tooth after the lands have been ground down several times.

From the standpoint of broach use, there are several factors which may cause unsatisfactory operation or failure. Many shops use a broach much too long before sharpening it. Broaches should be reground when the wear has reached 0.005 in., never more than 0.010 in.

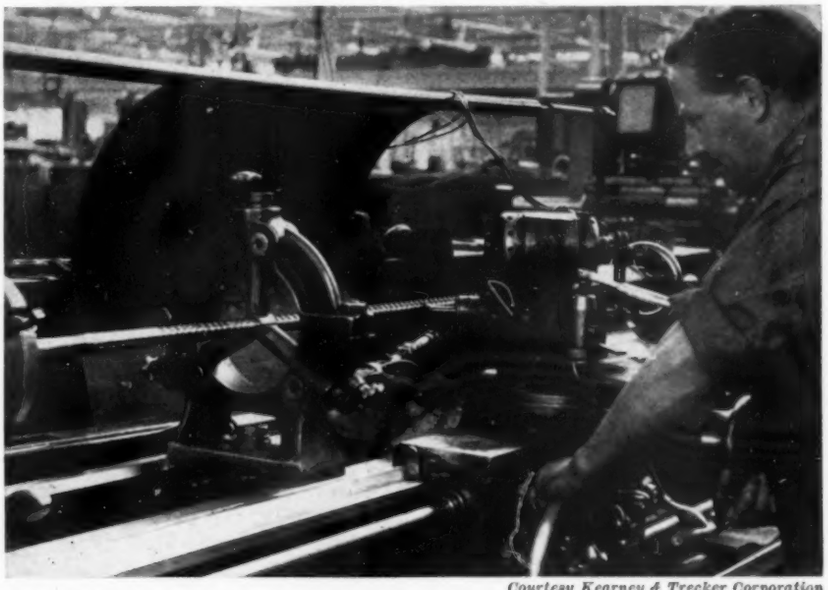
Length of cut should not exceed that permitted by the dimensions of the broach. In the accompanying table are shown dimensions used by one manufacturer on spline and round broaches for various lengths of cut in steel for averaging rise of tooth. The average size of step or rise per tooth is: 0.004–0.006 in. for splines; 0.0015–0.003 in. for round broaches; 0.003–0.006 in. for keyway and surface broaches, with smaller amounts for finishing teeth. The dimensions given in the table are subject to considerable variation, depending on material and amount of stock to be removed. For example, the allowable pitch on cast iron would be greater than for steel, because less chip room is required.

Faulty set-ups in the broaching machine often are a cause of broach failure. Worn or tapered keys give an uneven pull on the broach, thus tending to get it out of line with the hole. In internal broaching it is desirable to support the piece as near the bore as possible. If the face of the piece is rough, an adapter which supports the work too far from the bore will allow it to set at an angle and cause uneven pull on the broach. Where it is impossible to make an adapter which will support the piece near the bore, a self-aligning adapter having a spherical seat is needed for best results.

Cutting oils are no particular problem. Generally, a sulphur base oil is used unless the part is complicated and difficult to wash afterwards. Very light cutting oil is best for cast iron. Carbon tetrachloride, in amounts up to 25 per cent, in sulphur base cutting oil is useful in keeping chips from sticking, and helps obtain good finishes.

Tolerances in broach dimensions play a large part in the life of the tool; length of life decreasing rapidly as limits become smaller and smaller. Any tolerances less than 0.0005 in. decreases broach life considerably. Where there are variations in wall thickness, such as in a pulley with an extending hub, close tolerances cannot be held. The variations in wall thickness introduce variables which make it impossible to hold close dimensions on the bore.

Broaches should be handled at all times with extreme care to avoid breakage and nicking of teeth. When broaches are stored in a tool crib or storeroom, they should be oiled to prevent rust and should either be wrapped in individual cartons or stored in separate compartments. This also applies to the transportation of broaches from one department to another. If more than one broach is placed on a truck at a time, they should be separated in such a manner as to prevent contact which would cause broken or nicked teeth, and so reduce the life of the tool.



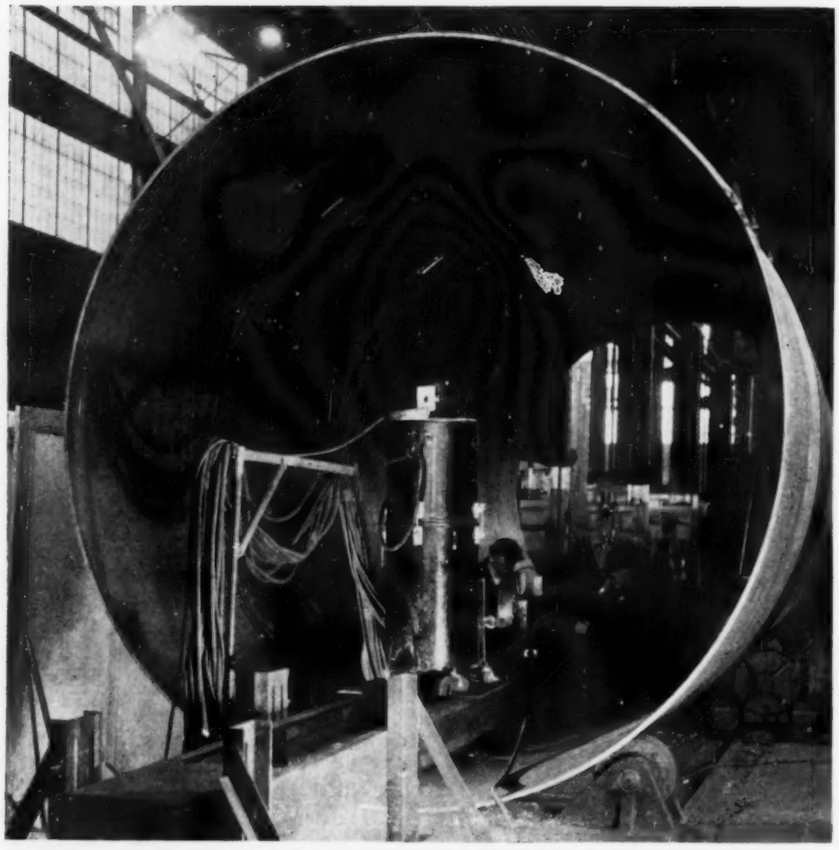
Courtesy Kearney & Trecker Corporation

*This lathe set-up uses a 60-grain cup wheel for both spline and round broaches. To get good production, the spindle on this grinder is run at the maximum speed by reversing the drive pulleys. The lathe turns the broach at about 100 r.p.m.*

Large segmental or combination broaches should not be disassembled at the machine, nor should individual sections be removed and replaced by the machine operator. The entire holder with the broach should be lifted out of the machine and taken to the toolroom where the broach can be handled properly.

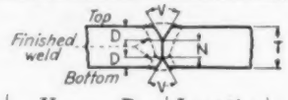
This article was made possible through the cooperation of the following companies: Colonial Broach Company, Detroit Broach Company, Dumore Company, Ex-Cell-O Corp., Kearney & Trecker Corporation, Illinois Tool Works, Norton Company, The Thompson Grinder Company, and The Oilgear Company.

# Torch-Made Tanks



*The first step in joining cylindrical sections is to Unionmelt weld the inside bevel. The work turns slowly on power-driven rollers. A cantilever track carries the welding head and Sturtevant collector for excess powder. Sections are added until the complete cylinder is built up*

**Plate Edge Preparation for Cylinder Welds**




| I (in.) | V (deg.) | D (in.) | Location | N (in.) | Welding Rod Diam. (in.) | Welding Rod Lb. of ft. of | Welding Current Amp. | Welding Current Volts | Welding Speed (in. per min.) |
|---|---|---|---|---|---|---|---|---|---|
| ½ | 60 | ⅛ | Bottom | 3/16 | 3/16 | 0.13 | 600 | 32 | 20 |
| | 60 | 3/16 | Top | | ¼ | 0.25 | 1000 | 39 | 18 |
| ¾ | 60 | 3/16 | Bottom | 5/16 | ¼ | 0.21 | 860 | 35 | 18 |
| | 60 | ¼ | Top | | ¼ | 0.25 | 1150 | 38 | 13 |
| 1 | 60 | ¼ | Bottom | 5/16 | ¼ | 0.25 | 900 | 35 | 16 |
| | 45 | 7/16 | Top | | ¼ | 0.46 | 1300 | 39 | 12.5 |
| 1¼ | 60 | 5/16 | Bottom | 3/8 | ¼ | 0.34 | 1000 | 34 | 16 |
| | 45 | 9/16 | Top | | ¼ | 0.63 | 1375 | 39 | 12 |
| 1½ | 60 | 3/8 | Bottom | 3/8 | ¼ | 0.43 | 1050 | 35 | 14 |
| | 40 | ¾ | Top | | ¼ | 0.96 | 1400 | 38 | 10 |
| 2 | 45 | ½ | Bottom | ½ | 5/16 | 0.57 | 1300 | 39 | 12.5 |
| | 30 | 1 | Top | | 5/16 | 1.21 | 1700 | 40 | 9.5 |
| 2½ | 45 | ½ | Bottom | ½ | 5/16 | 0.57 | 1300 | 40 | 12.5 |
| | 30 | 1½ | Top | | 3/8 | 2.49 | 2100 | 40 | 7 |

**Development of special equipment for the convenient welding of cumbersome cylinders makes improved construction possible**

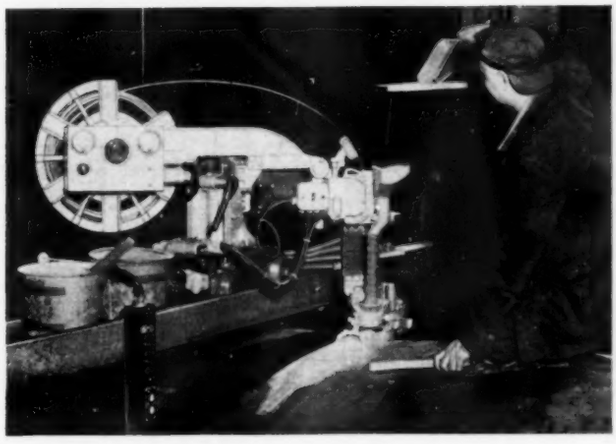
AN AUTOMATIC ARRANGEMENT developed by Allis-Chalmers Manufacturing Company for welding rotary kilns, coolers and dryers, transformer tanks and other large cylindrical shapes makes possible improved design and simpler production. The set-up utilizes the Unionmelt welding process, with suitable means for rotating the cylinders under the arc.

With this equipment a 9½-ft. diameter kiln shell of ¾-in. plate can be welded at about 12 in. per min., so that an entire girth joint can be completed in about 30 min. per pass, one inner and one outer pass being necessary for each joint. Cylinders from 8 to 10 ft. long are joined together to make kiln sections as long as transportation conditions permit. Complete kiln shells up to 140 ft. long have been shipped.

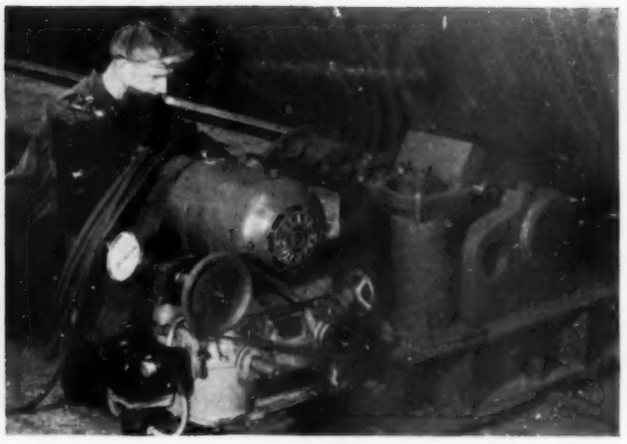
Welding gives more efficient metal distribution than possible with riveted construction, and total shell weight is reduced because butt straps and rivet heads are eliminated. It also gives a smooth inside surface, making it easier to line with fire brick. Welding also makes possible design improvements. A single plate, approximately 2 in. thick, is rolled from one piece and taper turned at each end to a thickness corresponding to the adjacent shell plate. This gives a stiff shell at the point where the maximum loads are carried and where refractory troubles are most frequently encountered. The floating riding ring which is welded to this plate is fabricated on a large positioning type jig as shown in the illustration.

The manufacturing procedure roughly is to cut the necessary bevel on the flat steel plates in a planer, after which the plates are rolled into cylindrical shape and seam-welded longitudinally with the Unionmelt machine. Sections are then tack welded together on an aligning track, after which the assembly is mounted on steel rollers, one pair of which acts as the driver for rotating the cylinder under the welding machine.

If the plate is more than ⅝ in. thick



*A pass on outside of the cylinder completes each butt weld. The welding head and vacuum cleaner, not shown, are mounted on I-beam which is moved from one section to the next. Work revolves on rollers*



*Through a Vari-Pitch speed changer and worm reduction, an electric motor drives the rolls on which the cylinder turns. A small motor is used to control the speed from the welding station*

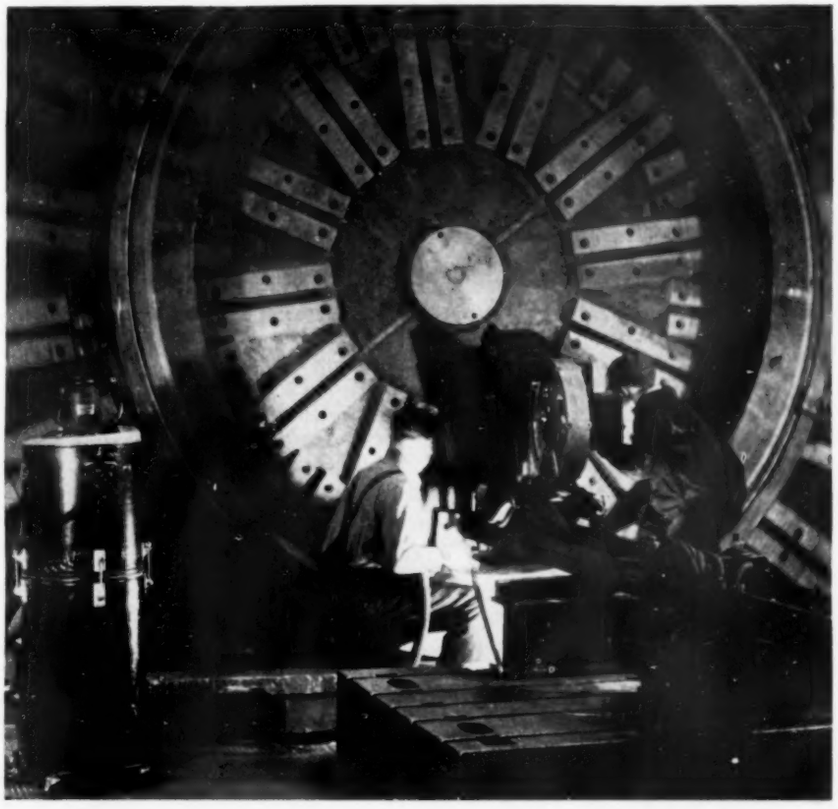
it is welded in two passes, the inner pass being made first. The welding machine is mounted on a portable cantilever track which is slightly longer than two sections. An electric motor, through a Vari-Pitch speed-changer and worm gears, drives the supporting rollers which turn the cylinder under the welding machine at the proper speed. After the weld is complete the machine is pulled back and two more sections added. When they have been welded in place the process is repeated until the full shipping length of the kiln has been built up.

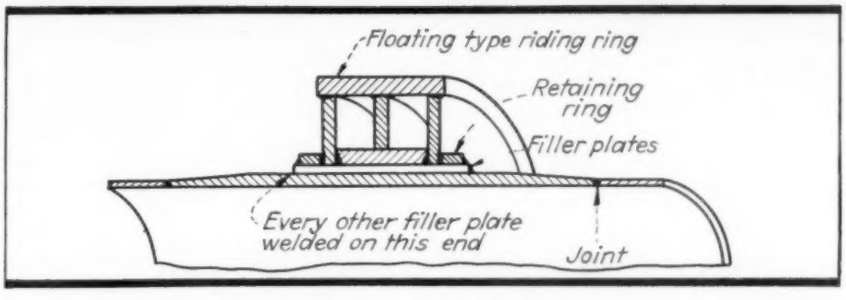
### Care Gives Fine Results

The welding machine is then mounted on a horizontal track across the top of the cylinder and the welding process is repeated in a similar manner on the outside of all seams. In the accompanying table are given approximate bevels, amperages and speeds used for various plate thicknesses for both passes.

By using this procedure it is possible to use smaller bevels than for general arc welding. Also, welds are made in one or two passes in plate thickness which normally would require many more passes, with chipping operations between.

Gamma ray tests on the first units manufactured by this method indicate that almost perfect welds can be secured if the proper technique is used. Bevels are carefully machined and must be correct as to angle. Amperage must be properly controlled within narrow limits and the fit between plates must be good. For any given angle there is a direct relationship between amperage and speed of travel, so that it is impossible to increase production by arbitrarily increasing both factors at once.






*Riding rings, which support the completed cylinders, are welded with the aid of this positioning jig table. R.p.m. can be varied to secure proper welding speed for different plate thicknesses*

# We Need Foremen

BY A. H. TIMMERMAN, PRESIDENT, NATIONAL METAL TRADES ASSOCIATION

**"We could run a bigger second shift if we could get the skilled men and the necessary foremen." That's what the superintendent of a machine tool plant told us a couple of weeks ago**

TODAY THE NEED for men who can act as foremen is growing greater as national defense orders pour out of Washington. Recently one airplane engine manufacturer was faced with the problem of increasing the supervisory force when employment jumped from 2,000 men to 9,000 men in a period of five months.

A member of the staff of the Industrial Relations Department of the National Metal Trades Association spent one month in intensively training men who could then take over as leaders in foremen meetings. These conference leaders were selected from the personnel of the company. During the time they were being trained the first conferences of the new foremen were held under the leadership of a N.M.T.A. staff representative.

From our experience we have found the conference procedure to be the best for pooling facts and suggestions from the experiences of the foremen; stimulating their desire to listen, think and talk about their problems; developing better understanding between foremen, management and employees; providing an effective means for interpreting, understanding and applying plant policies; securing better teamwork by reducing misunderstandings; aiding in analyzing jobs and discovering more effective ways or methods of doing them; helping materially in solving shop problems; stimulating respect for the points of view of others with resultant improvement in plant morale.

Whenever possible, it is desirable to select the men who are to be conference leaders from among the foremen. Meetings are held every week in a central location in the city to which the larger companies can send one or two men who will then become conference leaders for training their own foremen. If time is pressing, our local branches have provided intensive individual instruction for one or two weeks.

When foremen meetings start, our representative opens the first conference and conducts it. This is done to indicate the method of conducting an effective conference. After the first meeting, the newly trained conference leader from the personnel of the company conducts the conferences with our representative sitting in as a final check until it is apparent that the leader needs no additional assistance. Meetings are held twice a month to which the smaller companies can send their foremen thus making a group large enough for practical purposes.

Certain fundamental principles should be followed in all foremen training plans. In the first place, it must be remembered that any group of foremen represents a great fund of accumulated experience. No program is needed to "train" them because in most instances the sum total of their years of experience far outweighs that of the conference leader. It is the main job of the conferences to help the foremen work out the problems he will have in managing his men outside of the regular work of supervising the operations of his department. This includes such items as knowing how he can act under the restrictions laid down by the National Labor Relations Board, what he can say to his men and when he can say it and how they are to be treated in general.

A great burden rests on the conference leader. It is his duty to secure foremen's cooperation in a foremanship program, to plan foremen conferences using established procedures, to conduct the conferences, to train foremen to express themselves clearly, to have foremen pool their ideas and suggestions in solving plant problems, to make the conferences valuable to the foremen, to stimulate discussion, to unify the thinking of the group into clear and concise statements. Every aid for doing a good job should be given him by management. *Whenever he needs an answer to questions posed by the foremen group, top management should give it in time for the next meeting of the group.*

Any well planned and successful conference requires a certain logical procedure. One method of systematic development is: (1) State the subject clearly and concisely; (2) have the leader make a brief explanation of the subject, defining the words separately if necessary; (3) secure and draw out facts and data from the experiences of the group, selecting and writing on the blackboard the pertinent statements of the men in the group. One of the following methods of analysis will make for orderly thinking on the problem.

A pro and con analysis will develop the advantages and disadvantages in a given situation. It may be set up on the blackboard as follows:

ADVANTAGES DISADVANTAGES
SUGGESTED IMPROVEMENTS

An accident or difficulty analysis can be made to point out cause, effect, and fix responsibility in three ways:

WHAT'S WRONG? WHAT'S THE EFFECT? WHAT SHOULD BE DONE TO PREVENT ITS HAPPENING AGAIN?

WHAT WAS THE CAUSE? WHAT WAS RESPONSIBLE? WHAT WAS THE COST? SUGGESTED REMEDIES

WHAT'S WRONG? FOREMEN'S RESPONSIBILITY. RESULT OR EFFECT. WHAT SHOULD HAVE BEEN DONE?

The ways and means analysis can be used in connection with any of the above as shown in the headings at the right and should bring out constructive suggestions for future prevention or elimination of the trouble.

A responsibility analysis will develop and point out the responsibilities, which go with a job. It may be set up with three headings as follows:

SUPERVISORY RESPONSIBILITIES
MANAGERIAL RESPONSIBILITIES
INSTRUCTIONAL RESPONSIBILITIES

An analysis on the basis of qualifications will show the main requirements of a job under the following headings: PERSONAL CHARACTERISTICS, EDUCATION, EXPERIENCE.

The facts selected for summary on the blackboard should be rated by the men in the group in relative importance from one to ten. This will stimulate thought on the part of fore-

men in the group, thus emphasizing the most important points, and assisting in reaching a solution of the problem presented. After the solution has been obtained, discussion should be stimulated for devising some plan which will make the decision effective.

It is desirable at this point to summarize the results of the conference with a brief review of the points developed in the discussion. A summary should recognize differences as well as indicate facts on which everyone agreed. Usually summarizing can best be done by the leader. However, it may be done by a member of the group in order to emphasize the point that the leader is merely the representative of the group.

Some considerations in following a plant foremen conference program are:

Experience has shown that the size of the group should not exceed 25 nor fall below eight or ten members, the ideal number being 15 to 18 men. If the group is too small, a pooling of the training efforts in a community is desirable and will have the further advantage of widening the horizon of the men from the smaller plants.

Separate conference groups may be made up of assistant superintendents, department heads, foremen, or assistant foremen and sub-foremen both from office and shop. Prospective foremen and others who are being advanced may be included to a limited extent. The best results are obtained when the members of each group are most nearly of the same level of authority.

Conferences should be held at regular hours with definite times for starting and closing. A common practice is one or one-and-a-half hour period held on company time. Experience has shown that the best time is from ten to eleven o'clock in the morning or from two to three o'clock in the afternoon. In some plants conferences are held on Saturday mornings or on other days when the plant is not operating. Other less favorable times being used are: half-company time and half-foremen time at the close of the day shifts, a light lunch often being served before starting; or dinner meeting with a complimentary meal.

Most commonly used intervals for conferences are every week or every other week. Monthly conferences allow the interest of the group members to lag. Management should see that all foremen arrange their work so as to be in attendance at every session.

From the physical standpoint care should be taken in the selection of a suitable room for conferences. Factors to be considered are noise, interruptions, good light, proper ventilation and convenient location. The necessary equipment includes a well lighted blackboard, tables and chairs. Experience has proven that it is desirable for members of the group to face one another. It is sound practice to limit the number of visitors at any one time. Short visits by company executives are helpful in showing interest in the program, providing their stay is limited to a few minutes. Department heads or technical men may be called in for ten to fifteen minute talks on new products, new contracts, need for special attention or inspection on a certain job.

A member of the group should be elected to keep minutes of the meeting which will serve as a reference for points and conclusions developed in the discussion. The minutes should not include personal opinions, names of contributors or detailed discussions. All members of the group should receive a copy of the minutes promptly. In all foremanship groups there are men who talk freely and others who prefer to listen. The quiet man should be encouraged by direct questioning. The talkative man may be controlled by a difficult direct question or tactfully told to give the others a chance. Good technique greatly helps to distribute discussion.

The recommended series of conference subjects can be broken down into five major groups: Working With Others, Training, Industrial Relations, Shop Management, and Business Administration. Under the first heading the conference starts with an analysis of the foremen's job. This may be followed in order by conferences on the subjects outlined in the table.

## Topics for Foreman Conferences*

### Working With Others

1. The Foreman's Job
2. Self-Analysis for Self-Improvement
3. Employe or Performance Rating
4. Selecting Employes
5. Employe Placement and Follow-up
6. Dealing with the New Employe
7. Transfers and Promotions
8. Layoffs and Separations
9. Reducing Tardiness and Absenteeism
10. Safety—The Accident-Prone Employe
11. Putting Leadership to Work
12. Determining Methods of Approach
13. Taking a Personal Interest in Employes
14. Maintaining a Balanced Relationship Between Employes and Management
15. Giving Employes a Square Deal
16. Giving Top Management a Square Deal
17. Developing Cooperation Between Foremen and Employes
18. Cooperating with Other Foremen and Management
19. Rules, Regulations and Discipline
20. Developing Leadership Qualities
21. Plant Morale

### Training

22. Giving Orders or Directions
23. Training Employes
24. The Foreman as Instructor
25. Developing Understudies

### Industrial Relations

26. Personnel Administration
27. Labor Turnover
28. Stabilizing Employment
29. Health and Medical Service

### Shop Management

30. Working Conditions
31. Plant Organization
32. Plant Layout and Flow of Work
33. Records and Procedures
34. Material and Supplies
35. Wage Payment Policies
36. Wage Payment Plans
37. Time Study, Motion Study and Rate Setting
38. Job Analysis, Job Specifications and Job Rating
39. Production Planning
40. Routing
41. Scheduling and Dispatching
42. Control of Quality
43. Waste Reduction
44. Equipment Maintenance
45. Selecting New Equipment

### Business Administration

46. Principles and Policies of Management
47. Depreciation and Obsolescence
48. Organizing and Financing A Business
49. Budgetary Control
50. Cost Accounting
51. Marketing the Product
52. Reducing Unemployment Compensation Costs

*From N.M.T.A. Conference Leaders Manual

# Drawn Shapes

BY L. J. WEBER AND J. T. WEINZIERL, ALUMINUM COMPANY OF AMERICA

**Allowance must be made for the work hardening of aluminum and its alloys during cold drawing**

IN A DRAW PRESS the punch operates like that in a blanking press, but the stroke must necessarily be greater. Small pieces may be drawn in single-action presses, in which the blankholder is raised or lowered by spring or pneumatic pressure. For quantity production and for larger pieces, however, drawing is done in double-action presses, in which mechanical linkage or cams operate the blankholder.

The size and capacity of a drawing press depend upon such factors as the diameter and thickness of blank, shape of drawn item, and alloy and temper of the sheet being used. In Table V are given the capacities of presses used for drawing various size aluminum-alloy blanks.

There are five aluminum alloys that generally are suitable for producing drawn shapes. These are designated by Aluminum Company of America as 2S, 3S, 52S, 53S and 61S. The first three are generally called *common* alloys, while 53S and 61S are heat-treatable alloys.

When drawing *common* alloy sheet, the severity of the draw determines the temper to use. Annealed sheet is used for severe draws, while half-hard or even full-hard sheet may be satisfactory for the less severe draws.

Alloy 53S sheet is generally drawn from the annealed (*O*) or the quenched (*W*) temper, and the shell later brought to the fully heat-treated temper. Shells drawn from sheet in the quenched (*W*) temper require aging at 320 F. or slightly higher, the time of heating varying with the temperature chosen. When sheet in the soft temper is used, the shell must be heat-treated at 960 F. and then aged. The *W* temper is used wherever possible so as to eliminate the need for heat-treating the drawn shells, which may be difficult to handle and which distort during quenching. In most cases, the distortion from heat-treatment requires corrective operations.

The tools used in drawing aluminum may be divided into four parts: die, knockout, blankholder and punch. While these are similar to those used for other metals, the designer should take into account differences in amount of reduction per draw, radii on the tools, and change in metal thickness.

During drawing the metal strain-hardens and changes from the annealed to the harder tempers, with an increase in mechanical properties. It therefore becomes less workable, and the reductions per draw in successive draws must be decreased. For deep-drawn cylindrical shells in alloys 2S-O and 3S-O, the reductions in diameter per draw should be as shown in Table VI.

Since after the third draw there is little change in hardness, the 15 per cent value given in Table VI is suitable

*Fig. 1—Squares scribed on a flat sheet which later is drawn to form a rectangular shell distort as shown. Change in shape and area of the squares is especially noticeable at the corner of the shell*

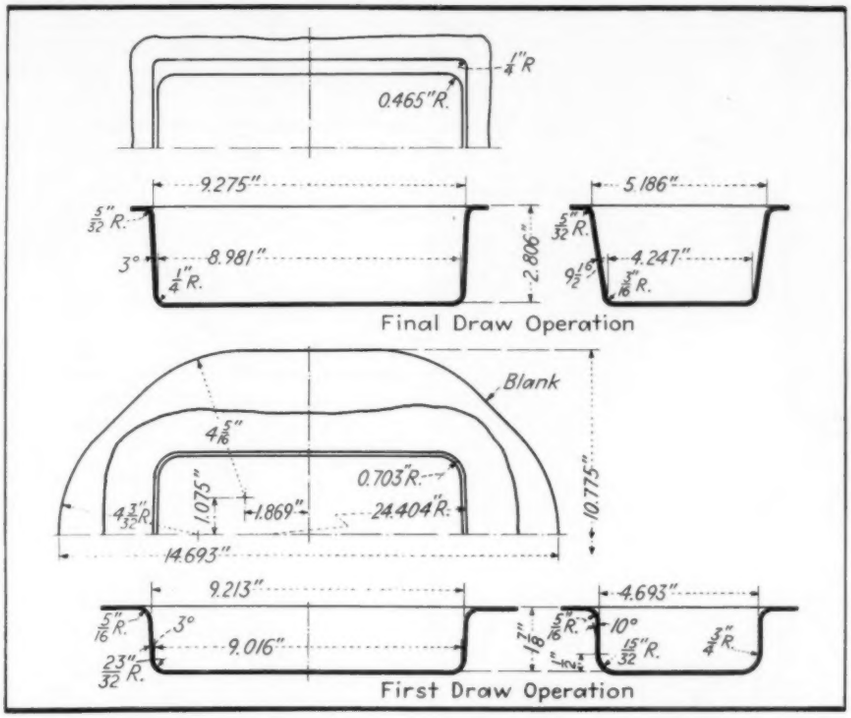



*Fig. 2—This sketch shows typical first and second operation shells, together with the developed blank for an aluminum pan*

type of draw, the alloy sheet to be formed, the final finish desired and the quantity to be made.

Cast-iron tools have been widely used for a small number of pieces where it is necessary to keep tool costs at a minimum. The saving in this case is obtained both in the cost of the material and in the cost of machining. Cast-iron tools also are well adapted for larger quantities when the requirements or surface finish on the drawn parts are not exacting. However, the presence of scratches and surface imperfections resulting from their use increases finishing costs if a highly polished surface is desired. While somewhat higher in cost, a number of grades of alloy cast-iron are sometimes used because they give better results.

### Steel Dies Are Best

On large production runs where the extra cost is justified, high-grade alloy tool steels have been found to give best results. They also are used for drawing shells from hard alloys and on work where scratches must be kept at a minimum. Oil hardening steels usually are used so that the maximum hardness

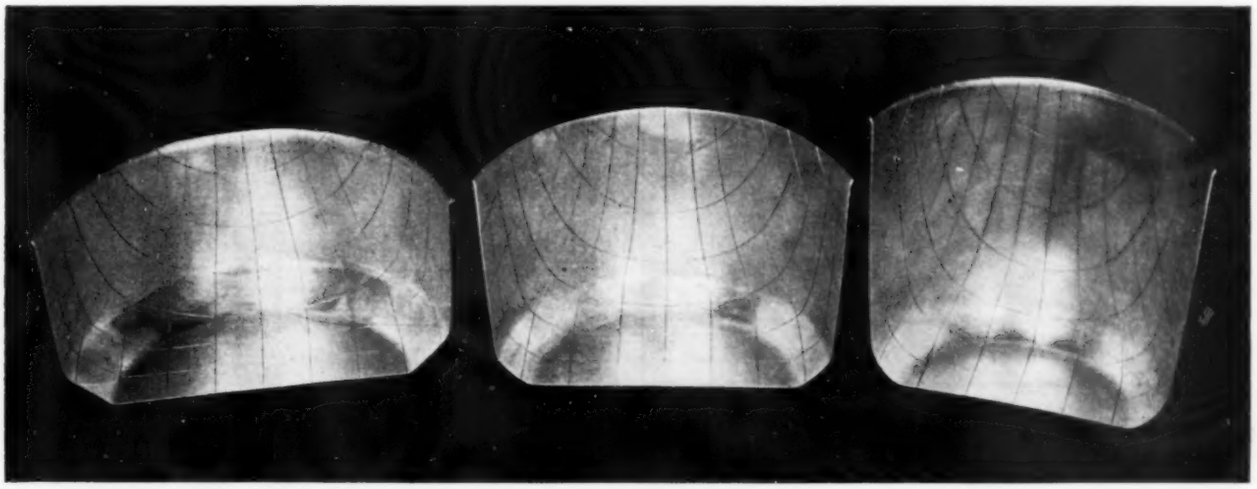


*Fig. 3—Flow of metal in drawn cylindrical shells is indicated by lines scribed on the blanks*

for the fourth and all later draws. While the values given in this table may be varied, they should not be exceeded appreciably. In fact, for harder alloys, such as 52S, in which the increase in strength is greater, the values given in the table may have to be reduced by as much as 10 per cent for the first draw and 5 per cent for succeeding draws.

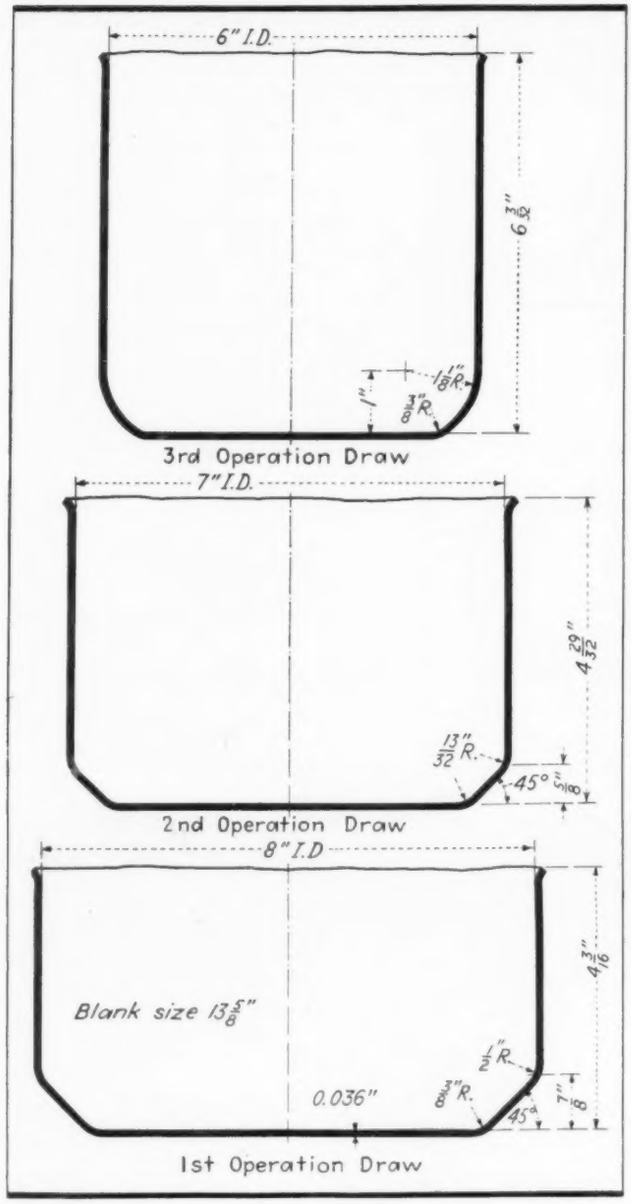
The radius on the die should be no less than four times and no more than fifteen times the original thickness of the metal. That on the punch should be held to a minimum of four times the thickness. If the radius is too sharp, the resistance to the flow of metal may cause fractures. If the radius is too large, wrinkling may occur in the side wall of the shell.

The drawing tools should be so designed that the original thickness of the sheet is changed very little. This practice differs from that for brass and steel sheet, which may be reduced in thickness as much as 50 per cent. It is therefore often necessary to redesign tools used for brass and steel when they are to be used in drawing aluminum.

Drawing tools are made from cast iron, high-grade alloy steel, or carbon steel, depending on such factors as the with minimum distortion is obtained during heat-treatment.

Intermediate in cost and performance between cast-iron and high-grade alloy steels are regular carbon steels with 0.6 to 1.10 per cent carbon.

Drawn shells usually are rectangular, cylindrical, or hemispherical, although odd shapes are not uncommon. In a rectangular shape as shown in Fig. 1, the greatest flow of metal occurs at the corners. This flow must be controlled to prevent wrinkles and fractures. Provision for this factor can be made by varying the draw radius. The dimensions of the original blank must be



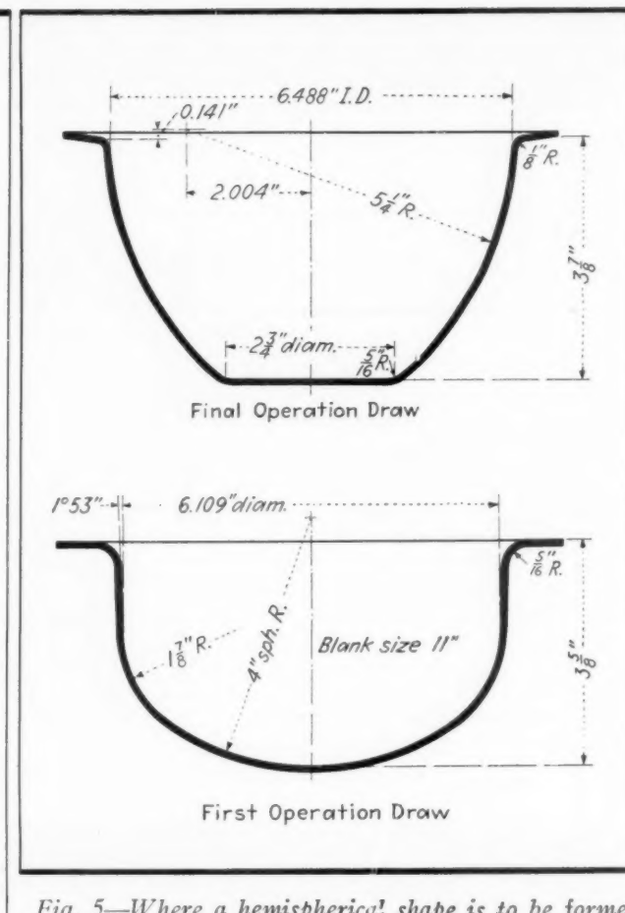




*Fig. 5—Where a hemispherical shape is to be formed in two draws it is important that the shell formed in the first draw have sufficient metal at proper positions*

*Fig. 4—Sequence of drawing operations for a cylindrical cup is indicated above. Die dimensions are given in Table VIII*

**Table V—Capacity of Presses Used for Drawing Various Blanks**

| *Type of Press* | *Capacity (tons)* | *Maximum Diameter of Shell (in.)* | *Maximum Thickness of Blanks (in.)* | *Maximum Depth (of Drawin.)* |
|---|---|---|---|---|
| Double-action toggle | 63 | 8 7/8 | 0.051 | 4 3/4 |
| Double-action toggle | 125 | 14 | 0.102 | 8 1/2 |
| Double-action toggle | 148 | 15 1/2 | 0.102 | 9 1/2 |
| Double-action toggle | 282 | 23 | 0.125 | 10 |
| Double-action toggle | 300 | 27 | 0.125 | 10 |
| Double-action toggle | 360 | 25 | 0.125 | 14 1/2 |
| Double-action toggle | 400 | 30 | 0.156 | 12 |
| Double-action toggle | 550 | 30 | 0.187 | 17 |
| Double-action toggle | 500 | 37 | 0.250 | 14 |
| Hydraulic | 1300 | 49 | 0.3125 | 24 |

**Table VI—Reduction in Diameter for Deep Shells**

| *Operation* | *Desired Reduction* | *Permissible Reduction* |
|---|---|---|
| Blank D | | |
| First draw ($D_1$) | 40 (or less) D | 42D |
| Second draw ($D_2$) | $20D_1$ | $25D_1$ |
| Third draw ($D_3$) | $15D_2$ | $18D_2$ |
| Fourth draw ($D_4$) | $15D_3$ | $15D_3$ |

such that there is enough metal to obtain the desired shell. The shape of the blank naturally depends on the shape of the item drawn. Fig. 2 shows typical first and second operation shells and the blank for a rectangular shell. The die dimensions for the various draws are given in Table VII.

The flow of metal in a drawn cylindrical shape is illustrated in Fig. 3. Notice that although the shape of the original squares has been changed considerably, their area is about the same, indicating there has been very little change in thickness. Fig. 4 shows the sequence of drawing operations, and Table VIII gives the die dimensions.

Metal drawn into the form of a dome or a hemisphere has a tendency to wrinkle, especially in the thinner gauges. If such a shape is to be made

in one draw, the ratio of the inside diameter of the drawn shell to the original metal thickness should be kept below 200; otherwise wrinkles will usually form. If two draws are used to form the shell, it is important that the first shell have sufficient metal at the proper positions so that the second shell will draw without fracturing or wrinkling. The drawing operations are illustrated in Fig. 5.

### Lubricant Prevents Scratching

A lubricant for drawing work has two important functions: In the first place it allows the blank to slip readily between the blankholder and the die. Also, it prevents scratching and galling while this movement takes place. Mineral oils or compounded mineral oils are most often used. Water-soluble drawing compounds have been tried, but not found satisfactory. Some of the oils that have proved suitable in production operations are the following:

| *Severity of Draw* | *Lubricant Employed* |
|---|---|
| Light ..... | Light lubricating oil |
| Medium .... | Mixture of light oil and heavy lubricating oil |
| Severe ..... | Heavy lubricating oil or 50 per cent mutton tallow and 50 per cent paraffine mixtures |
| Very severe.. | 30 per cent mutton tallow and 70 per cent paraffine mixtures. |

*A double-action toggle press makes the first draw on an aluminum cooking utensil. A chute takes the shell to the next press*

**Table VII—Die Dimensions for Drawing Rectangular Shapes**

| | |
|---|---|
| First draw..... | Add 2.2 times blank thickness to punch dimension |
| Second draw..... | Add 2.2 times blank thickness to punch dimension |
| Final draw..... | Add 2 times blank thickness to punch dimension |

**Table VIII—Die Dimensions for Drawing Cylindrical Shapes**

| | |
|---|---|
| First draw..... | Punch diameter plus 2.2 times thickness of blank |
| Second draw..... | Punch diameter plus 2.3 times thickness of blank |
| Third and succeeding draws..... | Punch diameter plus 2.4 times thickness of blank |
| Final draw of tapered shells..... | Punch diameter plus 2 times thickness of blank |

**Table IX—Effect of Drawing on Mechanical Properties**

| *Alloy* | *No. of Draws* | *Thickness Inches* | *Tensile Strength* | *Per Cent Increase* | *Yield Strength* | *Elongation* | *Approx. Hardness* |
|---|---|---|---|---|---|---|---|
| 3S | 0 | 0.103 | 16,000 | .... | 6,000 | 30.0 | 0 |
| | 1 | 0.100 | 18,740 | 17.2 | 16,700 | 11.0 | 1/4H |
| | 2 | 0.097 | 22,140 | 38.4 | 20,800 | 9.0 | 1/2–3/4H |
| | 3 | 0.097 | 23,710 | 48.2 | 21,900 | 8.0 | 3/4H |
| | 4 | 0.098 | 24,240 | 51.5 | 22,300 | 7.5 | 3/4H |
| 52S | 0 | 0.103 | 29,150 | .... | 14,200 | 27.0 | 0 |
| | 1 | 0.101 | 34,390 | 18.0 | 31,600 | 6.0 | 1/4–1/2H |
| | 2 | 0.090 | 39,710 | 36.2 | 37,100 | 5.0 | 3/4H |
| | 3 | 0.087 | 42,680 | 46.5 | 38,600 | 5.5 | H |
| | 4 | 0.089 | 43,750 | 50.2 | 36,100 | 6.0 | H |

It should be remembered that proper choice of lubricant for a particular plant is a matter of experience and depends on the tool design, tool material, and sheet thickness. Cast-iron and low-carbon steel tools require a heavier lubricant to prevent scratching than do hardened steel tools. The greater the reduction per draw and the sharper the radii, the heavier must be the lubricant to allow the blank to slip readily into the die. Thick sheet requires a heavier lubricant than thin sheet. It is general practice to use mutton oil and paraffine when drawing thick sheet.

Not only should the oil have the properties required during drawing, but be readily removable by the regular cleaning operation used in the plant. It is advisable to avoid the necessity for using special cleaning practices, since they usually interfere with the flow of materials in production and thereby increase the cost.

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*The fourth article in this series on the cold working of sheet aluminum will appear in an early issue.*

# IDEAS FROM PRACTICAL MEN

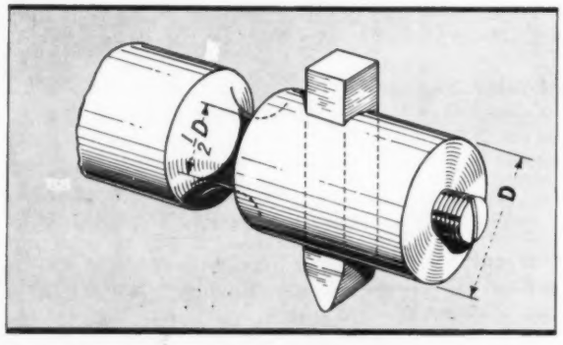
## Niched Boring Bar Does Chatter

BY ARTHUR SILVESTER

It has been suggested by Arthur L. Greene (*AM*—Vol. 84, page, 754) that a boring bar niched as shown in the illustration has sufficient spring and wrist action to eliminate chatter. Supposedly it takes up shock and vibration coming to the bar.

This is something new. Of course the niching does give a certain amount of spring to the tool or bar; but I would expect this to produce a smoother bore rather than to eliminate vibration and chatter. With regard to vibration and chatter, neither is caused by the boring bar providing it is of the correct diameter for the hole being bored, the length of the bore is not unusually long, the bar is supported properly, and the toolbit located accurately. Other contributing factors are an incorrectly ground toolbit, insecure clamping of the work, and end play in the machine spindle.

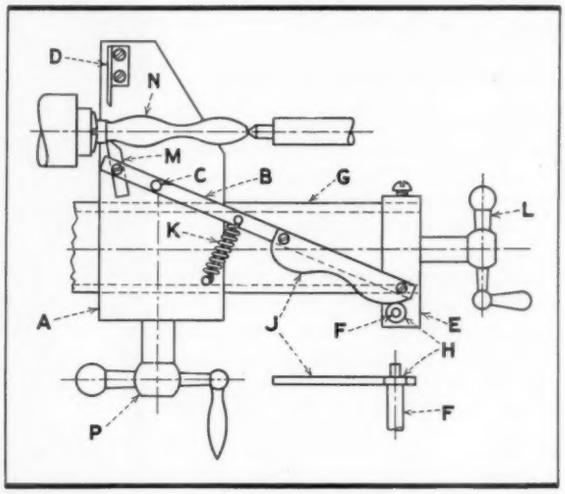
We were interested enough in Mr. Greene's niched bar to make a test of it. We set up a piece of round stock 4 in. outside diameter, 1 in. inside diameter, and 4 in. long. We first bored the hole from 1 in. to $1\frac{1}{4}$ in. with a solid 1-in. diameter boring bar




*It has been suggested that this niched boring bar reduces chatter. The writer, having tested such a bar, refutes this claim*

to a plug-gage fit. Then we niched the bar as shown in the illustration and proceeded to bore the hole to $1\frac{1}{2}$ in. diameter.

While a satisfactory finish was obtained with the niched bar the job took too long due to the weakened condition of the bar causing the tool to push away from the work the moment contact was made. Also, the tool continued to cut a little when run through the bore a second time without changing its position. However, the job obviously was not of sufficient duration to show the effect of the niched bar on the life of the tool bit.




*Long thin pieces can be form-cut to irregular shape with a pivoted bar which carries the cutting tool at one end and a cam on the other end*

## Cam-Operated Tool Form-Cuts Thin Stock

BY DOUGLAS TURNER

The described cam-operated cutting tool and lathe set-up is one we are using to turn irregular pieces too long and of too small a diameter to be machined with a forming cutter.

A plate *A* was attached to the top of the cross-slide and carries a bar *B* arranged to turn through a small angle on the pivot pin *C*. The plate *A* also carries the cut-off tool *D*. The plate *E* acts as a support for the post *F*. This unit is adjustable along the cross-slide *G* and can be clamped at any convenient position along its length. The post *F* is designed to carry a roller *H* at its top which turns on the post *F*. A cam *J* is screwed to the bar *B* as shown and the spring *K* creates a tension on the bar *B* holding the contour of the cam against the roller. Thus when the handle *L* of the cross-slide is turned to advance plate *A*, the end of the bar *B* carrying the tool bit *M* is caused to move in and out as well as longitudinally causing the tool to turn a contour on the work *N*. When the tool reaches the end of the cut, it is only necessary to back off the tool with the handle *P* of the cross-slide to bring the cut-off tool into play to cut off the work.

To get the proper contour of the cam for a given shape, a piece is turned up by hand to the desired shape, placed in the lathe and a cam blank is attached to the bar. A filler collar is attached to the post *F* under the roller so that the roller is *above* the cam blank. The tool is then moved in steps along the contour of the piece, small arcs being scribed on the

blank; the scriber is in contact with the roller at each point. The desired contour of the cam is thus obtained and cut out up to the scribed lines whereupon the filler collar is removed bringing the roller in the right position vertically to bear on the cam. Adjustments can be made by moving the plate *E* or changing the cam on the bar *B*. A stop is provided also for limiting the travel of the cross-slide so that pieces turned are all the same size.

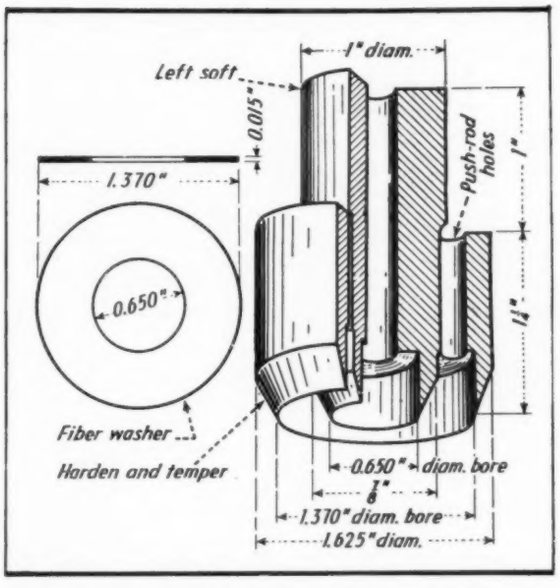
## Accurate Washers from Thin Material

BY S. ARTHUR

The machining of thin fiber washers with the aid of a boring plate, as described by Laurence F. Southwick (*AM*—Vol. 84, page 924) will undoubtedly produce satisfactory results. However, such washers can be made economically in small quantities with the punch shown in the illustration. In large quantities, a manufacturer of such washers can supply them at a cost sufficiently low to make it prohibitive to produce them in one's own shop either with such a fixture as described by Mr. Southwick, or the punch illustrated herewith. For example, the washer mentioned by Mr. Southwick and shown in the drawing herewith, can be purchased for $3.99 per thousand, $2.49 in 5,000 lots, and $1.99 in 10,000 lots.

The punch illustrated can be made for $4.00, whereas a boring plate of the type used by Mr. Southwick could not be made for less than $10. Punches for various size washers can be kept in stock, which circumvent the flexibility of the boring plate on which any size of washer can be made.

Assume that a workman had to make 25 thin washers at one time. With Mr. Southwick's fixture, it would take at least one hour to drill, bore, saw and turn this number. On the other hand, we have punched five to six dozen washers in that time.

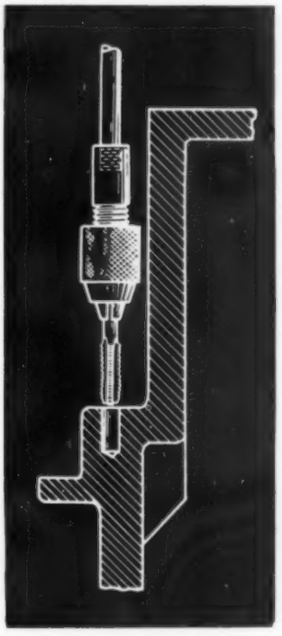



*Small quantities of thin fiber washers can be made with this punch. However, large quantities of such washers can be purchased more economically than they can be made with a punch or machine fixture, such as a boring plate*

## A T-Wrench Tap Extension for Close Work

BY ROBERT S. ALEXANDER

We had some holes to drill and tap close to the inside wall of a large casting. It was necessary to use an extension for drilling as the drill-press chuck and spindle could not get close enough to the side of the casting to operate efficiently. This left an awkward hand tapping job as we did not possess a set of taps long enough to clear the top of the casting in order to use a tap wrench of the conventional type.



*This wrench extension was designed for tapping the holes in close quarters and adjacent to deep walls of a large casting*

We solved our problem by making the simple extension shown. It consists of a T-handled tap wrench of the chuck type with the handle removed and a hole drilled in the end and tapped to receive the threaded end of a rod long enough to clear any obstruction. A few strokes of the file and our extension rod was squared sufficiently to take the conventional type tap wrench at the other end, thus completing a very efficient and satisfactory extension tap wrench.

When the extension rod—which can be of any length—is not in use, the tap wrench can be used in the regular manner, providing a safety set screw is placed in the tap hole. The set screw is tightened on the regular handle, and obviates the usual tendency of this type of handle to slip in the cross hole while tapping by hand.

## Welding Kinks for the Locomotive Shop

BY A. H. CARROLL

Arc welding locomotive guides with bare rods has been a noted time killer, sometimes requiring ten hours per guide. This time can be reduced materially by substituting $\frac{5}{16}$ or $\frac{3}{8}$ in. heavy coated electrodes for the usual $\frac{3}{32}$ or $\frac{1}{16}$ in. bare rods. The only precaution necessary is in the deposition of the initial bead along the edge of the guide. This bead must be laid about $\frac{3}{8}$ in. in from both edges and worked outwards with

a semi-circular motion so as not to burn away the edge of the guide.

Some railroads weld plates on locomotive frames adjacent to spring hangers to prevent the latter from chafing the frame. After following this procedure, we had an epidemic of broken locomotive frames, a peculiarity of which was that the break occurred beneath the bead at the edges of the wearing plate. The weld apparently caused a tiny fracture in the frame which was propagated during service. We have discontinued the use of such plates and are now welding the frame solid at spring hanger locations with wear-resistant bronze. This procedure has proved to be entirely satisfactory.

When flame-cutting scrap, especially such items as bolsters where the operator must cut through two or more thicknesses with a layer of rust between each, hold the torch parallel with the work and cut one layer at a time. Through the kerf formed by this cut, clean the rust from the next plate with hammer and chisel and proceed in the same manner. This works equally well on scrap boilers when there is heavy scale on the inside.

Broken binder bolts are sometimes located so that they can be removed easily, but those with counterbored heads require the removal of a spring before they can be replaced. This is especially true when making running repairs in the enginehouse. Repairs to such bolts can be made quickly by flame cutting the broken bolts 1 in. from the frame. and welding on a bolt body of the proper length. When this is done with the welding torch by an experienced operator, it will serve as well as a new bolt.

## Correct Stock Diameter for Cutting Threads

BY H. R. FOWLER

The acceptance of the 75 per cent depth of thread in tapped holes during the past ten years has unquestionably minimized tap breakage and spoiled work. But trouble is still encountered when it comes to cutting smooth threads with a die, especially on alloy steels. The majority of such troubles can be overcome by applying the same line of reasoning when cutting a male thread as when tapping a female thread.

What should be the stock diameter to obtain good threads? For example, suppose we have to make 1-in. studs with eight National Course threads per inch. First, reduce the diameter of the blank 5 per cent of the double depth of the thread. In this case, the double depth of the thread is 0.162 in.; therefore, the blank should be 0.008 in. under 1 in. or 0.004 in. on a side. This clearance is usually ample to allow the metal to flow while the threads are being cut. By doing this, you obtain more accurate gaging, because you have a better chance to get the fit on the pitch line where it should be, instead of on the top of the thread. Also, you get longer die life and smoother threads, regardless of the material being cut.

I doubt if there is any reason why any but pipe threads should ever fit top or bottom. Don't be afraid to take off enough metal. Even if there should be a slight flat on top of the thread, it does no harm—the fit is on the pitch line.

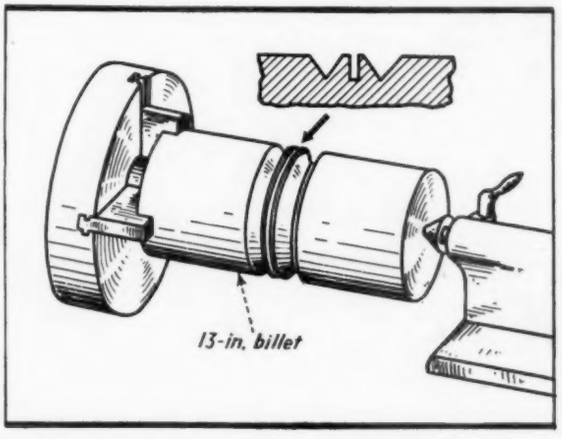
This has been discussed before, but if repetition on a subject in a different way will help produce good work easier, it is worthwhile, especially in view of government work in many plants which is subjected to minute inspection. Anyone not accustomed to such work, will find that making Nos. 3, 4 and 5 thread fits is a more difficult job than ordinary screw cutting, and the reduction of the major diameter as explained above helps a lot.

To repeat, when turning external threads, reduce the stock diameter 5 per cent of the double depth of the thread. There are many tables available which gives the sizes of the various pitches to use when making the necessary calculations.

## Grooved Billets Speed Cutting of Rings

BY V. V. ROBERSON

Recently we had to machine rings $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in. wide from 13-in. billets, which were too long to bore without being cut in half. In order to obtain the best possible chuck grip, we groove the billet. To save




*In machining thin rings from billets, a groove near the end leaves a narrow edge for gripping in the chuck. One lathe operation can be saved by cutting two grooves near the billet center and parting between the grooves*

one lathe operation, I cut two grooves in the billet near the center and part it between the grooves.

The 13-in. billet is chucked in the lathe, and near the center I make a shallow cut with a parting tool. Then, to the right and left of this cut, at a space equal to a No. 4 thread, I cut V-grooves with a blunt nosed threading tool. Finally, I complete the parting operation.

Each half of the billet can then be chucked by the edge adjacent to the groove, thus making a firm short hold for the chuck jaws. The narrow chucking edge allows more metal to protrude from the chuck for making the rings.

# Armament

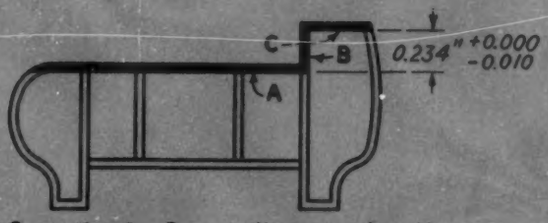
SECTION OF AMERICAN MACHINIST

## Rear Sights for Browning Machine Guns

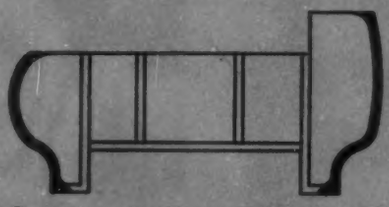
Also

## JOBS FOR THOSE IDLE MACHINES

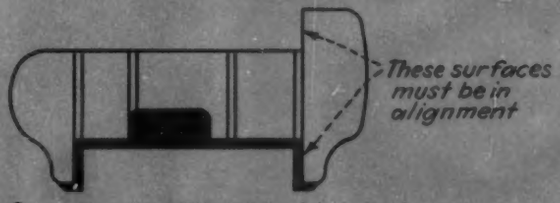
Operation 1—Grind top and bottom of SAE 1035 WD forging. Hold on magnetic chuck on table of grinder.



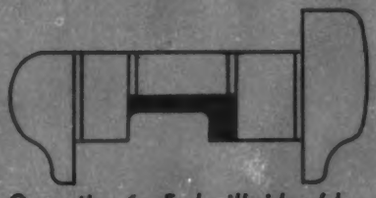

Operation 2—Gang mill upper edge. Note: All subsequent operations are located from these surfaces.



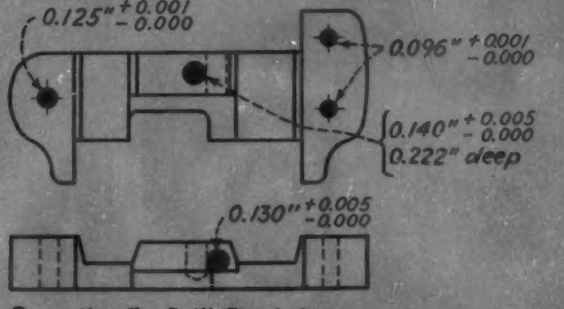
Operation 3—Form mill right end.
Operation 4—Form mill left end. Note: These two operations are performed in alternate sides of same fixture. See Fig. 2.




Operation 5—Mill slot and lower edge, including slot for pivot screw.

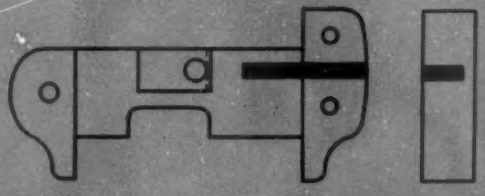


Operation 6—End mill side of lug so surface is level across body of slide.

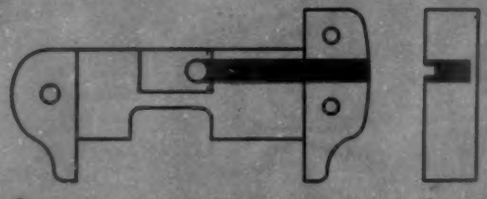



Operation 7—Drill five holes.
Operation 8—Ream five holes. See Fig. 3.

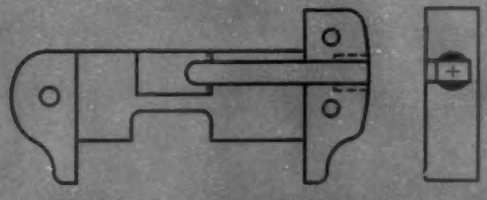
Operation 9—Rough and finish mill clearance for sight leaf. See Fig. 4.



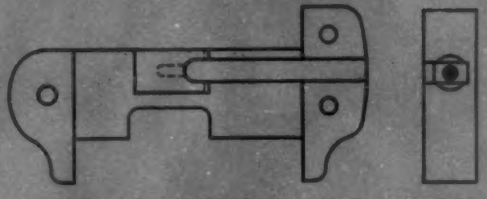
Operation 10—Rough mill slot for half-nut, using Woodruff keyway cutter.



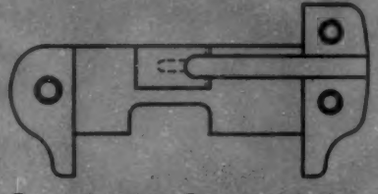
Operation 11—Finish mill slot for half-nut, using 0.140 in. diameter end mill in bench lathe. See Fig. 6.



Operation 12—Counterbore at end of half-nut slot for binding screw.



Operation 13—Drill hole for half-nut spring. Bushing in drill jig supports drill close to point of entrance.



Operation 14—Countersink three holes.
Operation 15—Tap three holes.
Operation 16—File in bench fixture.
Operation 17—Stamp part number.
Operation 18—Blacken in furnace.
Operation 19—Inspect in gage.

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# REAR SIGHTS FOR BROWNING MACHINE GUNS

BY ALLEN G. BURDETT
*Vice-President, Service Machine Company*

OF THE TEN component parts, not including small screws and pins, which make up the assembly of the rear sight for the .30 calibre Browning machine gun (M-1917), the leaf, the rear-side slide and the drift slide require the largest number of machine operations. This sight is of simple design, yet all of the component parts must be made accurately if the sight is to function properly under service conditions.

As the operations on the rear-side slide are typical of those performed on the other major parts, they are shown in detail in Fig. 1. While most of the dimensions on this slide have a maximum tolerance of 0.002 in., and a few have even larger tolerances, it has been found desirable to hold all of the dimensions on this and other parts close to the nominal sizes shown on the drawings.

A Thompson hydraulic surface grinder is used for the first operation on the rear-side slide, which consists of grinding the top and bottom sides of the SAE1035 W.D. forging. The forgings are placed side by side on a magnetic chuck on the table of the grinder, so that a number can be finished at the same time.

Since all subsequent operations on the rear-side slide are located from surfaces *A* and *B* as finished in operation 2 (Fig. 1), it is essential that these surfaces be milled accurately with a fine finish. Two cutters are used. The slab mill used for surface *A* has been ground specially with side cutting teeth so that it also cuts surface *B*, while the second cutter machines surface *C*. As in the case with all other milling fixtures used for this slide, the fixture for operation 2 is doweled to the machine table, so that it can be removed and then replaced accurately without aid from a skilled set-up man. Semi-skilled operators find it easy to perform the operations on the component parts for this rear sight, because all of the tooling has been carefully designed and it is practically impossible either to position the part incorrectly or to insert a part that has not been machined to proper dimensions in previous operations.

In Fig. 2 is shown the milling fixture for operations 3 and 4 on the rear-side slide. Here, a few accurately positioned plates and clamp bars fitted to a standard Yankee machine vise make up an accurate milling fixture which holds sixteen pieces on one side for form milling the right end, and 16 pieces on the other side for form milling the left end. Once the first sixteen pieces have been milled on the right end, a total of 16 finished pieces are obtained in each pass of this fixture under the milling cutters. Pieces finished in the first side of the fixture are transferred as a group to the second side of the fixture for machining on the other end in the next pass. While these two surfaces do not mate with other parts of the sight, they form the surfaces against which the fingers of the gunner rests when adjusting the sight, and they are kept as smooth as possible. Burrs raised by the milling operation in this set-up, and in others on the component parts for the sight, are removed with a file by the milling machine

**Fig. 1—In all, nineteen operations are needed to finish a rear-side slide for these sights from an annealed and pickled SAE1035 W.D. forging. There are nine other major component parts**

operator before the parts are moved along to the next operation.

The milling of the slot and lower edge of the rear-side slide is indicated as operation 5 in Fig. 1. Here, again, cutters are ganged on the machine arbor. This operation is performed in a milling machine, while the next operation, which consists of end milling the side of the lug, is done in a special set-up on a bench lathe, where the part is mounted on a fixture attached to the cross slide, and the end mill is held in the lathe spindle.

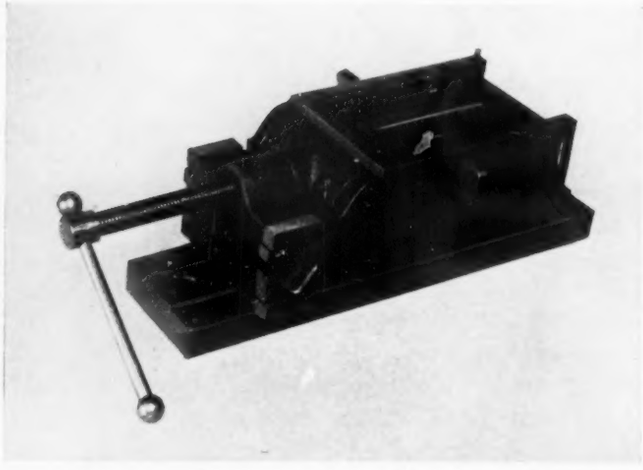


Fig. 2—Operations 3 and 4 on the rear-side slide forging are performed in a milling fixture built around a standard Yankee machine vise. The form cutters for the right and left ends of the slide are mounted side by side on the milling machine arbor and sixteen pieces are placed in each side of the fixture, location is against surfaces *A* and *B* machined in operation 2

After operation 6, these slides are delivered to the sensitive drill press, where five holes are drilled, and then reamed, in operations 7 and 8. The jig used is shown in Fig. 3. Again, the part is located from surfaces *A* and *B* milled in operation 2. Simple cam clamps hold the part in position against stop pins fitted in the cold rolled steel plate which constitutes the principal part of the jig. Feet are welded at each end of this plate to make up the body of the jig. After four holes are drilled through the top of the piece, the jig is turned on its side for drilling the 0.130 in. hole. Not only must these five holes be accurately positioned, they also must be of correct size. Particularly is this true in the case of the two 0.096 in. and the one 0.125 holes which later are tapped for Class 3 screw fits.

Three standard side-cutting milling cutters are assembled on the arbor of the milling machine for gang milling clearance for the sight leaf in operation 9. A roughing and a finishing cut is taken, since the surfaces produced must be smooth. The set-up for this operation is shown in Fig. 4. Here, it will be noted, a very simple fixture is used, with heavy clamps to hold the piece tightly in position. Also shown in Fig. 5 are the go and not-go gages used to check the two slots produced in this

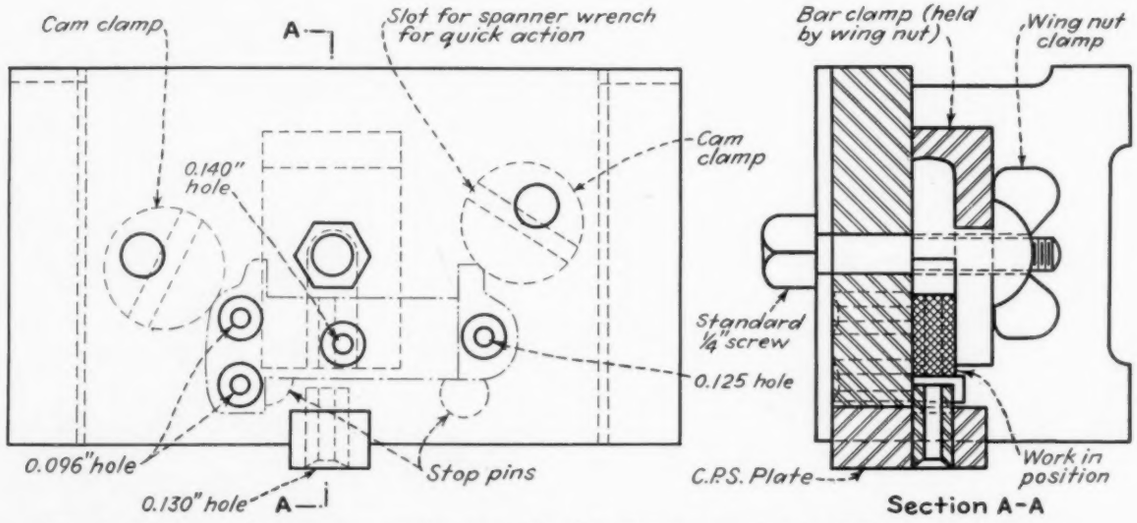



Fig. 3—The seventh operation on the rear-side slide forging consists in drilling four holes from the top and one from the side. The drill jig for this operation locates surfaces *A* and *B* (operation 2, Fig. 1) against stop pins with cam clamps

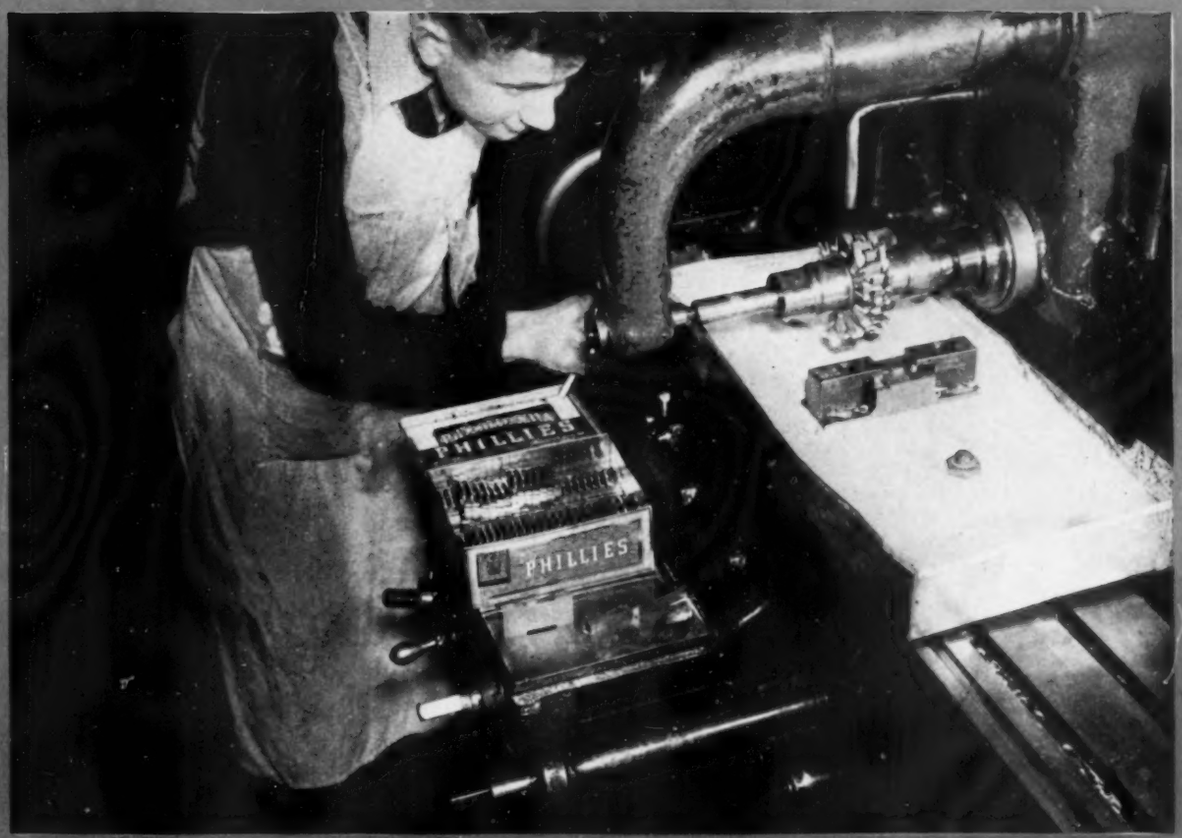



Fig. 4—Three standard milling cutters are assembled on the milling machine arbor for the ninth operation on the rear-side slide. Accuracy of cut and fine finish are essentials in this operation. Parts are milled one at a time, being held in a simple locating fixture doweled to the machine table

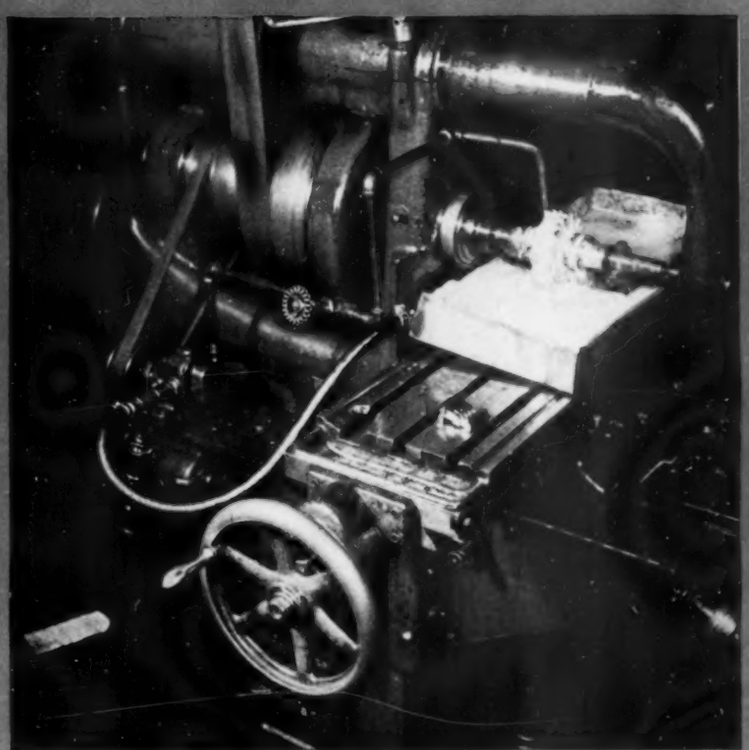


Fig. 5—Of particular interest at this time, because of the need to put every piece of available equipment to use, is this arrangement for providing a copious flow of coolant to the milling cutters shown in Fig. 4. A tin pan was made with a hole that fitted closely around the work fixture, then the joint was sealed with plaster of paris. The flexible drain line was run to a Brown & Sharpe pump mounted on the side of the machine

Fig. 7—Secret of success in making the rear-side slide so that it will slide freely on the sight leaf, yet have no objectionable play, is to finish the sliding surfaces with a fine file in a carefully made fixture. Glass-hard blocks guide the file

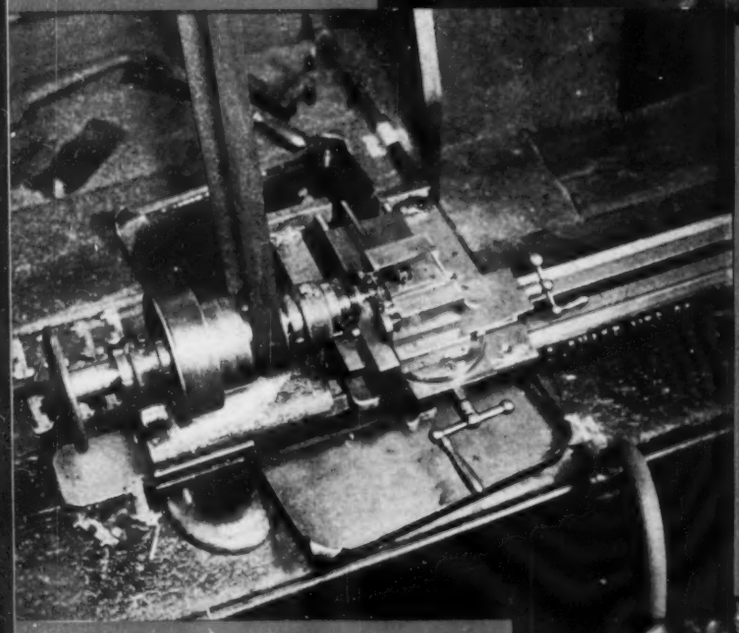


Fig. 6—A simple fixture mounted on the cross-slide of a bench lathe holds the rear-slide for operation 11. Here, the end mill in the lathe spindle finishes the half-nut slot in one quick pass

Fig. 8—Unlike the filing fixture shown in Fig. 7, this one is made in the form of special vise jaws with hardened insert blocks

milling operation. A straightening operation is performed between the rough and finish milling cuts of operation 9. This straightening operation is critical because of the differences in section involved, and a skilled operator is used.

Because a miller equipped for coolant was not available for operation 9, an inexpensive arrangement was developed which probably will have application in other shops. A simple pan of sufficient size to fit the table of the milling machine was bent up from tinplate and soldered to make the pan watertight. Then, a hole was cut in the bottom of the pan so that it would fit closely around the fixture mounted on the machine table. The pan next was clamped in position on the table and plaster of paris was used to seal the opening around the fixture. A short piece of pipe was soldered in a hole in one end of the pan, and a piece of hose was used to connect this outlet to a standard Brown & Sharpe pump mounted on the side of the miller. Discharge from the pump is through a pipe arrangement, as shown in Fig. 5, with a valve being provided so that flow of coolant can be shut off between cuts. Drive for the pump is by belt from the small step on the cone pulley drive for the machine.

This rear-side slide must fit accurately on the sight leaf, so finished dimensions produced in operation 9 are held to the low limits, thus providing material for filing to finished size in a later operation. A hand miller with a Woodruff keyway cutter is used for rough-milling the half-nut slot in operation 10, Fig. 1. Finishing of this slot, operation 11, is done with an end mill in a bench lathe set-up as shown in Fig. 6. Here, the holding fixture is mounted on the cross slide of a simple bench lathe, as the cutter is held in the spindle collet. With such a set-up, a semi-skilled operator can machine parts rapidly to a high degree of accuracy.

Clearance for the binding screw on the half-nut assembly is provided by counterboring at the end of the slot in operation 12. This is a simple drill press operation requiring only an inexpensive locating fixture. The next operation, which consists of drilling a hole in the lug for the half-nut spring, is more critical, since the drill must start against a curved surface. The drill jig for this operation is arranged to support the drill close to its point of entrance into the work. There is not much clearance at this point for a guide bushing, but by requiring some care on the part of the operator the light section used has proven satisfactory.

Next, the three holes through the two ends of the rear-side of the slide are countersunk on both sides, and these holes are tapped in one pass with Class 3 special spiral-point Bath taps. Final sizing of this part is done in special bench filing fixtures, see Figs. 7 and 8. Glass-hard slots in these fixtures guide the file so that finish dimensions on the part are held within close limits. It has been found best to make the parts with an easy slip fit on the go gages, while holding the dimensions so that the not-go gages will not enter. Hand filing in these fixtures is less expensive than grinding, and releases the surface grinder for other operations.

After the inspector has checked the filed

Fig. 9—Each rear-side slide receives 100 per cent inspection with go and not-go gages. In this gage all five "go" plugs must enter freely the holes drilled in the part

parts, they are stamped with the part number and are delivered to the heat-treating department, in this case to a sub-contractor, where an oil black finish is applied. Upon return to the machine shop, these parts are given a final inspection in Ordnance Department gages, as shown in Fig. 9, and they are then delivered to the storeroom for later assembly into the finished sight.

The other part which requires a considerable number of operations is the sight leaf, Fig. 10, which also is machined from a forging. This part, like the rear-side slide, is inspected at frequent intervals during and between the machining operations, go and not-go gages being used. Further, all jigs and fixtures are so designed that parts not to proper size will not fit into position, and so automatically are discovered before additional machine work has been performed.

Interesting set-ups in the manufacture of this part are shown in Figs. 11, 12 and 14. Since quantity requirements were low, purchase of additional manufacturing equipment was not justified and existing equipment was adapted to the job by making jigs and fixtures. For instance, in Fig. 11 is shown the use of a hand turret lathe for a straddle milling operation. Here, the work holding fixture is mounted on the rear slide, ordinarily used for cut-off operations, with the slide clamped in the forward position, and the work bed down between the milling cutters by hand operation of the screw feed.

Because of the size of the center slot in this leaf, and the relative thinness of the material surrounding the slot, it constitutes a major problem when manufacturing costs must be held to a minimum. The operation line-up for producing this slot includes rough milling with a side cutter after holes have been drilled at each end of the slot. Then, the parts are delivered to a punch press where the die set shown in Figs. 12 and 13 finishes this slot, including the squaring of the two ends. Of interest in this operation is the method used to prevent closing of the holes drilled to provide clearance for the adjusting screw at the two ends of the slot. If the punching operation were performed with these holes empty, they would be closed up because of the pressures exerted. To prevent this, common wire nails of diameters to fit closely in the two drilled holes are inserted just before the punching operation. The nails are destroyed in the punching operation, since the punch shears through the metal on the center line of the drilled holes.

Also the leaf is bent to some extent due to the punching pressure and a straightening operation is necessary. This has been incorporated in the punching operation, by providing for coining of the piece at the bottom of the punch stroke. How this is done is indicated in the drawing of the die set shown in Fig. 13.

The half-round slot in the right-hand side of the leaf for the elevating screw is finished by milling with a special convex Woodruff-type cutter in a bench miller. The set-up and fixture used are shown in Figs. 14 and 15. Like all other operations on parts for this

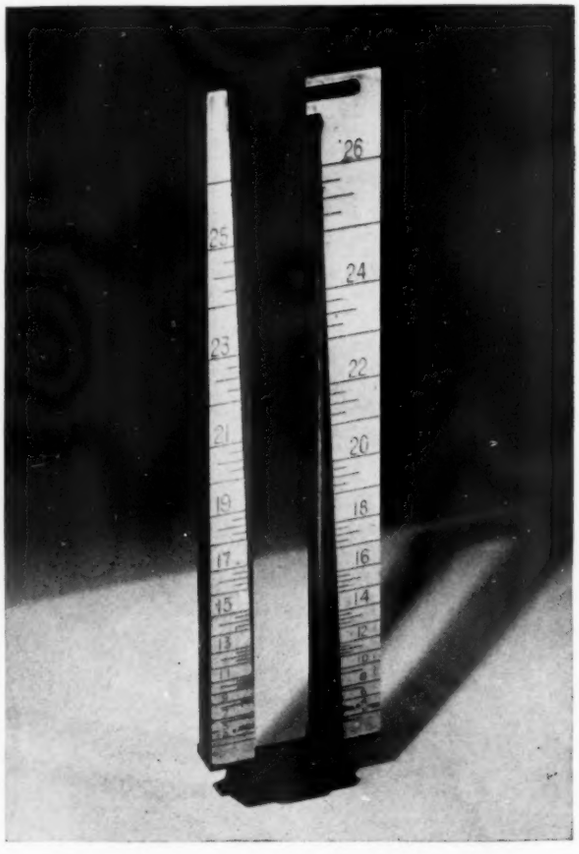



**Fig. 10—The sight leaf is machined from a SAE1035 W.D. forging and must be held within close dimensional tolerances**

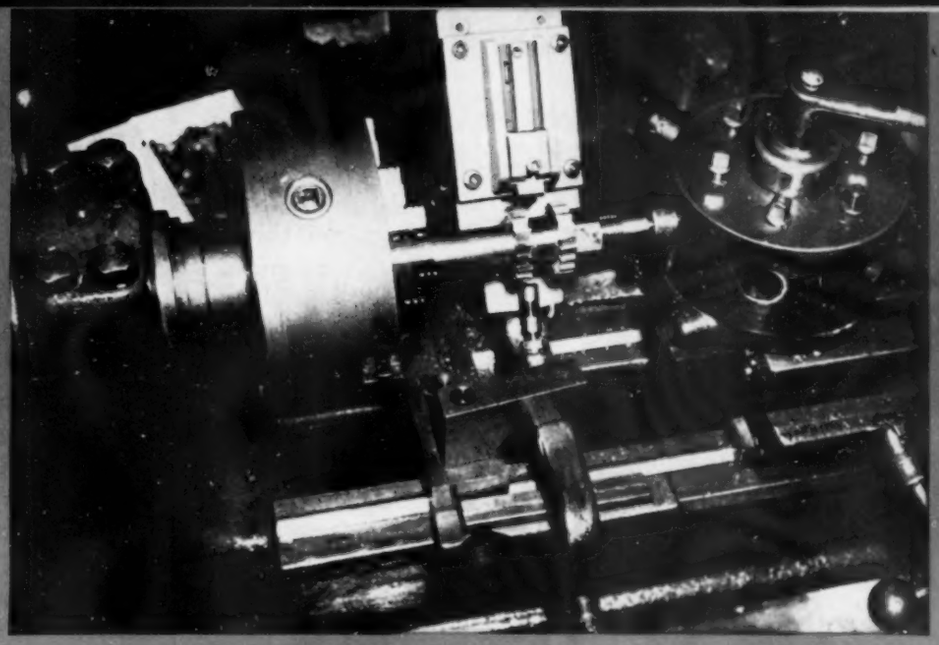


Fig. 11—Another example of the possibilities of adapting available equipment for defense work through the use of proper tooling is this use of a hand turret lathe for straddle milling the hinge lug on the end of the sight lead forging. Here the fixture is mounted on the cut-off tool slide

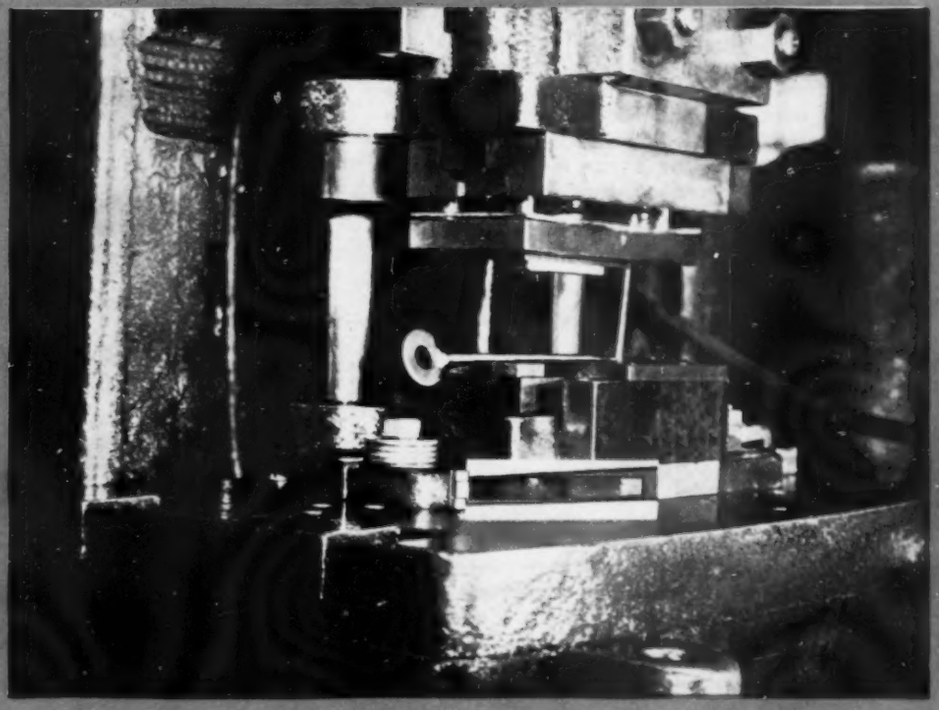
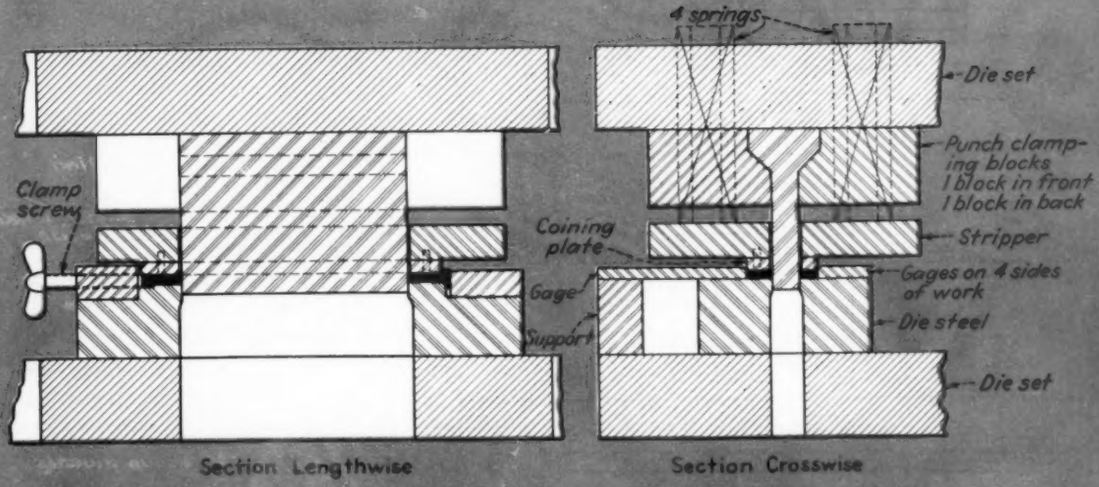


Fig. 12—Several punch press operations are performed on the sight leaf and the drift slide. This set-up, for which the die is shown in Fig. 13, is used to square the ends of the slot in the sight leaf and is arranged to coin the pieces for straightening at the bottom of the stroke

Fig. 13—This die set finishes the slots in the sight leaf forging, including squaring the two ends of the slot. The two punch clamping blocks are of such height that at the bottom of the stroke they strike the stripper plate, forcing the coining plate against the piece so as to remove any bending caused by the punch



machine gun sight, the tolerances on this groove are close, so light feeds are used and light cuts are taken.

The engraving of elevation lines and numerals on the face of this leaf requires considerable care, as no sight of this type can be more accurate than its markings. Further, since the sights must be interchangeable, the engravings must be such that the reference line always is in a fixed relation to the trunnion hole through the bottom of the leaf. All of this is checked carefully with a special Ordnance Department gage after the leaf has been completed. All surfaces on this leaf are oil blackened, and then this coloring is removed by polishing the two engraved surfaces at each side of the leaf.

Because of the care used in machining the component parts for the rear sight, assembly of the completed sight presents no major problems. It is merely a matter of drawing the proper parts out of the stockroom and putting the necessary components together with standard machine screws and pins.

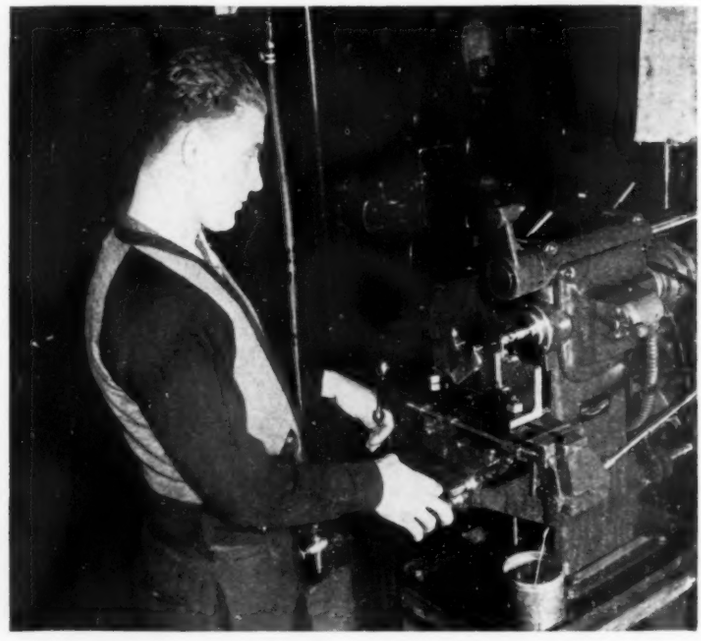
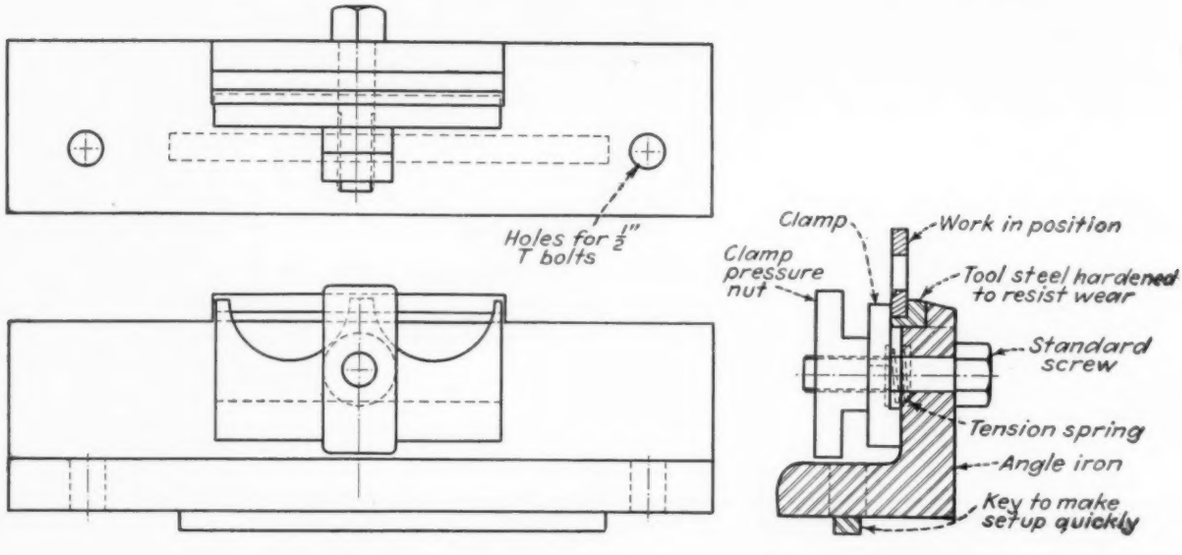


**Fig. 14—Half-slot in the sight leaf for the elevating screw is milled from the solid in this set-up on a No. 4 Burke bench miller. Fixture used is shown in Fig. 15. A special convex Woodruff keyway cutter is used for the half-round adjusting-screw slot**

**Fig. 15—A simple, inexpensive fixture holds the sight leaf for milling the elevating screw slot, as shown in Fig. 14. Like all other fixtures used for the machine gun sight, this tool is doweled to the table of the machine**



# JOBS FOR THOSE IDLE MACHINES

Despite whopping defense contracts, many small shops still have idle equipment. Here's how they should go about getting their share of work

IT IS NOT NECESSARY to have a huge government contract to do your share in the defense program. In addition to turning out actual government contract work, you can:

*Manufacture parts and sub-assemblies* for companies engaged in national defense work. Many machine tool makers, airplane motor and parts manufacturers, and general machinery fabricators are farming out parts which can efficiently be made outside. Though your machines may not be the very latest, there is undoubtedly much of this work in your neighborhood which you are equipped to do.

*Do tool and die work* for concerns still tooling up for defense work. Rarely do companies begin tooling before they get actual contracts, but when they start, they can often use much extra tool, die, jig and fixture making capacity.

*Manufacture non-defense items* on which companies doing government work have had to curtail production.

### HOW TO CONTACT CUSTOMERS

The foregoing is all very well, you might say, but how do I get in touch with the various people? Whom do I write? What's his address? What should I say? Well, here's the way to go about it:

*Government Work:* Although much government work is placed as a result of competitive bidding, almost none in the metalworking field is allocated in this way. Most is the result of negotiated contracts, the bulk of the orders being for the Ordnance Department and the Air Corps.

The first step in securing possible work of this nature is to consult the defense production liaison officer at any Federal Reserve Bank or branch. This officer knows in general what products are wanted, and the manufacturer must determine roughly which items he can make. The bank officer will then contact the nearest regional procurement office of the Army or Navy. He will also explain Army and Navy regional organizations. Federal Reserve Banks are now getting brochures explaining government procurement systems, which will be available to all interested persons. In addition, all local chambers of commerce which are members of the United States Chamber of Commerce have directories showing regional Army and Navy offices and the officers in charge.

The Federal Reserve Bank officer is also liaison man for big manufacturers who subcontract parts, and will be glad to put any small manufacturer in touch with the right ones. Very small concerns having a few tools not in constant use should get in touch with other such local firms and form a pool. For information on how to form a pool, write to Morris L. Cook, Employment Division, National Defense Commission, Washington, D. C. Small plants collectively can afford to hire a coordinating technician and government contact man whereas no single one could do so. The technician can examine each part and product wanted by large assembly plants and the Army and Navy, and can advise the small manufacturers whether to make it and how.

*Subcontract Work:* To all manufacturers in your vicinity who are engaged in considerable defense work, send a letter outlining the equipment you have available, the type of work you are qualified to do, and the tolerances you are in the habit of following. Lists

of manufacturers awarded government contracts are published regularly in several metal-working papers, including AMERICAN MACHINIST. These lists are compiled from bulletins issued weekly by the Department of Labor, Division of Public Contracts, Washington, D. C. Bulletins will be sent regularly to any firm requesting them.

To learn about aircraft parts work, write the Automotive Committee for Air Defense, 8505 W. Warren Ave., Detroit, Mich., describing the type and volume of work you do, character of equipment installed, personnel employed, etc., and thereby list your plant as available for aircraft parts work. If possible, send a representative to visit the exhibit of aircraft parts which the committee is establishing at its Detroit headquarters. There, with the aid of U. S. Army Air Corps, the committee is accumulating blueprints of plane models selected for this program, and disassembled parts and sub-assemblies in various stages of fabrication. Experts in attendance will reveal tolerances, manufacturing techniques used elsewhere, and bugs likely to be encountered. A special pass from the Automotive Committee for Air Defense is necessary to attend the exhibit.

Another way of contacting possible sources of business is by examining the advertising sections of metal-working publications. Most prominent machine tool companies advertise, and from their ads you can obtain their addresses. A letter addressed to the works manager, production manager or general superintendent outlining the type of work you can do will bring a courteous reply. If you can work to extremely close limits you might tackle aircraft motor and parts makers—listed from the advertising pages of aviation magazines.

Still another way of contacting potential customers—good for all except government work—is to advertise in metal-working magazines. Several of them have "Contract Work" sections for which rates are reasonable. These sections are widely read by just the persons you want to contact—production men confronted with the necessity of farming out some of their work. Any publication will send full details as to circulation, coverage and cost on receipt of a penny post card.

*Tool and Die Work:* The best way to get tool and die work is to keep up with plants in your neighborhood who get government contracts and contact them *immediately,* describing your facilities. Either a letter or a personal visit will often get results. Often you can learn through "grapevine" channels in advance of the official bulletins released by the government.

*Non-Defense Items:* Here again the best way is to follow the list of government awards and approach those companies that might be crowded on regular production. At the same time you could ask about the possibility of doing some tool, die, jig or fixture work, and could also inquire about making a few parts, either now or later. That way you could kill two or three birds with one stone. Do this whenever possible, as you'll save the time of men who are terribly busy. They'll thank you for it, realize you're on your toes, and have a much higher regard for your company.

**DON'TS**

A wrong approach will ruin your chances of doing any work for certain companies. Despite the fact that a given plant may need your facilities badly, your first problem is one of selling, and a bad first impression may take years to erase.

*Don't* bid on work you're not equipped to do *efficiently.* You'll lose either the contract or your shirt.

*Don't* try to get business from aircraft parts makers if you think a thousandth is close work. The same applies to machine tool companies.

*Don't* bombard companies with letter after letter after they say no. They either want work or they don't.

*Don't* try to profiteer on contract work. Any company farming out work is cutting into its own profits by exactly the amount of profit you demand. You're performing a service for your industry and for your country, not trying to get rich quick.

*Don't* solicit work which would require installation of more equipment. Machines are scarce as hens' teeth.

*Don't* try to work for plants half way across the country. Plenty of work is available close by, and there's no point in helping tie up transportation facilities by shuttling parts all over the place.

*Don't* make promises you can't keep. Give yourself an extra week on delivery dates; if you finish an order three days early your customer will be everlastingly grateful, if you make him wait three days you may tie up his assembly line and lose his future business.

*Don't* skimp on quality. Your own inspectors will pass anything you tell them to, but your customers won't.

TIME-DATA SHEET NO. 27

# Sensitive Drill Press Operations—III

(*Continued from Time-Data Sheet No. 26*)

*Methods of Holding Parts:*

Work is held on the drilling table by hand, or with clamps, vise or jig. When a jig is used it eliminates the necessity of a layout, and also gives greater accuracy. If the tolerances are close, or if the activity justifies it, jigs should be used.

*Allowed Values and Tables:*

The values for countersinking, shown in the formula expression, allow time merely for removing burrs and the sharp edge of the metal. When it is necessary to countersink for a screw or bolt head, the miscellaneous values in Table No. 11 should be used.

The tables for drilling and tapping include the length of the lead for both drills and taps. The tables for drilling include depths to 2 in. drilled with a ¾ in. diameter drill or smaller. The tables for tapping include depths of 1 in. tapped with a ¾-10 tap or smaller. If, in any case, a hole deeper than those specified has to be drilled or tapped, do not use the tabulated values as a base but use the drilling or tapping time per inch as specified in the formula. It also is necessary to read the value for each hole from the table; *i. e.*, if there are two ½ in. holes to be drilled in 1 in. thick material it would be incorrect to take the time for drilling 2 in. with a ½ in. drill. The correct procedure would be to take the value for drilling 1 in. and multiply it by two.

In computing tapping values for the tables, the lead for a "second" or plug tap was used. On this type of tap the lead usually extends back about four threads.

*Drills:*

Carbon steel drills formerly were used for holes up to and including 13/64 in. diameter. They have been supplanted by high speed steel drills which can be run at a greater speed. It was therefore necessary to reduce the time values for small drills, found in the old formulas, to correspond with the time values for high speed steel drills. A No. 11 drill (0.191 in. diameter) or smaller can be run at the maximum speed of the machines now in use in the shop without danger of burning.

When drilling copper, the drills used should be ground with a longer point than when used in iron or steel. The lip should also be slightly undercut. This practice has proven successful in shop sections where much copper is drilled.

The operator should insist that his drills be ground correctly. If not, the tendency will be to produce an oversize hole. When the drills are run at too high speed they will burn at the edges or the point will mushroom.

When drilling for a bottom tap, drill the hole deeper than specified on the drawing by one-half the diameter of the tap.

*Cleaning and Oiling:*

Time has been allowed for applying lubricant to the tap on every other hole that is tapped.

Each operator is supposed to keep his machine cleaned and oiled. For this purpose an allowance of 0.10 hr. is made daily for oiling and 0.25 hr. weekly for cleaning. Two percent has been added to all values in the tables and to those values used in the formula expression for these allowances.

*Formulas:*

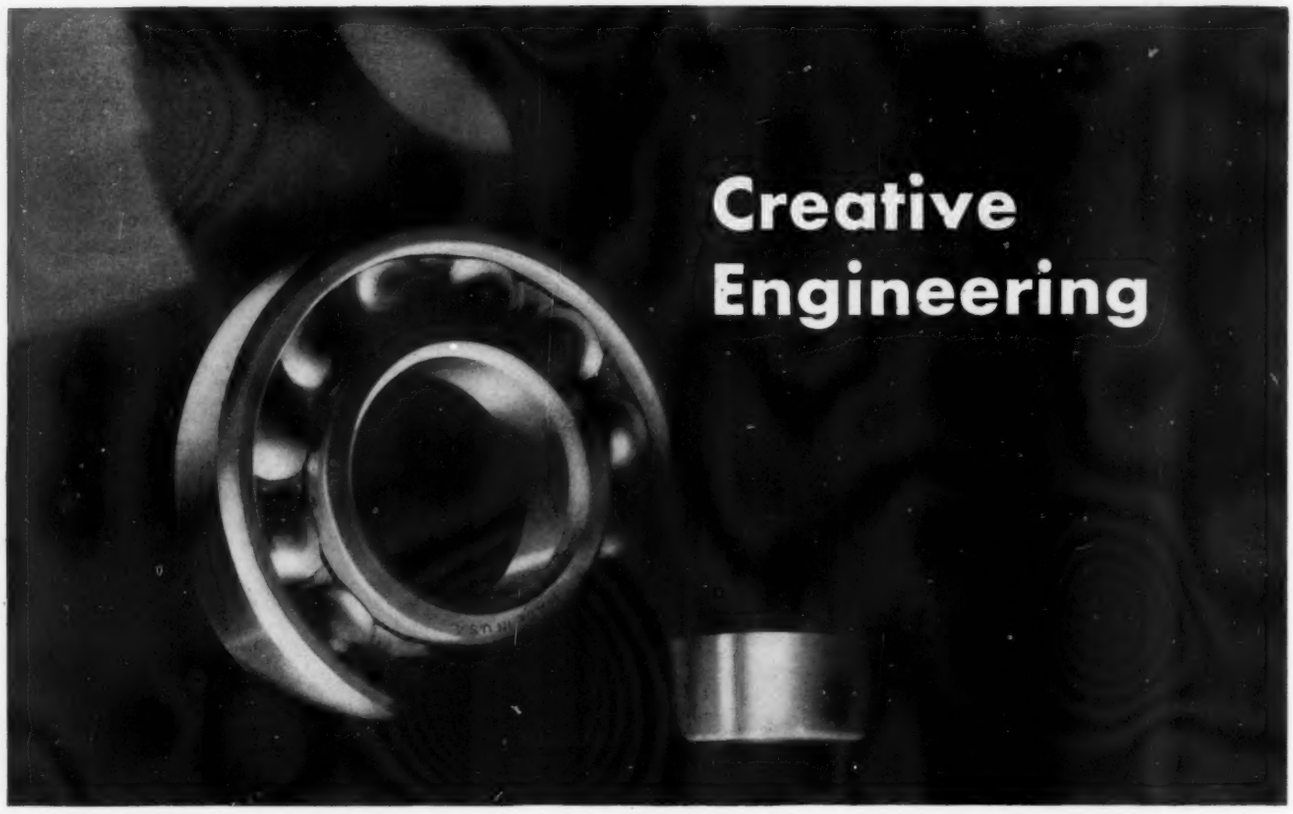
Allowable spindle speed can be calculated from the following formula for any size of tap or drill:

$$\text{Revolutions per minute} = \frac{\text{Surface feet cut per minute} \times 3.82}{\text{Diameter in inches}}$$

(*Continued on Time-Data Sheet No. 28*)

**Table No. 2—Drill Brass**

| Size of Drill — Inches | DEPTH OF HOLE IN INCHES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ⅛ | ¼ | ⅜ | ½ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1⅝ | 1¾ | 2 |
| 1/8 | 0.0002 | 0.0003 | 0.0004 | 0.0005 | 0.0007 | 0.0008 | 0.0009 | 0.0011 | 0.0012 | 0.0013 | 0.0014 | 0.0016 | 0.0017 | 0.0018 | 0.0021 |
| 9/64 | 0.0002 | 0.0003 | 0.0005 | 0.0006 | 0.0007 | 0.0009 | 0.0010 | 0.0011 | 0.0013 | 0.0014 | 0.0016 | 0 0017 | 0.0018 | 0.0020 | 0.0022 |
| 5/32 | 0.0002 | 0.0004 | 0.0005 | 0.0006 | 0.0008 | 0.0009 | 0.0011 | 0.0012 | 0.0014 | 0.0015 | 0.0017 | 0.0018 | 0.0020 | 0.0021 | 0.0024 |
| 11/64 | 0.0002 | 0.0004 | 0.0005 | 0.0007 | 0.0008 | 0.0010 | 0.0012 | 0.0013 | 0.0015 | 0.0016 | 0.0018 | 0.0019 | 0.0021 | 0.0022 | 0.0026 |
| 3/16 | 0.0002 | 0.0004 | 0.0006 | 0.0007 | 0.0009 | 0.0010 | 0.0012 | 0.0014 | 0.0015 | 0.0017 | 0.0019 | 0.0020 | 0.0022 | 0.0024 | 0.0028 |
| 13/64 | 0.0003 | 0.0004 | 0.0006 | 0.0008 | 0.0009 | 0.0011 | 0.0013 | 0.0014 | 0.0016 | 0.0018 | 0.0020 | 0.0021 | 0.0023 | 0.0025 | 0.0029 |
| 7/32 | 0.0003 | 0.0004 | 0.0006 | 0.0008 | 0.0010 | 0.0011 | 0.0013 | 0.0015 | 0.0017 | 0.0019 | 0.0020 | 0.0022 | 0.0024 | 0.0026 | 0.0030 |
| 15/64 | 0.0003 | 0.0005 | 0.0007 | 0.0008 | 0.0010 | 0.0012 | 0.0014 | 0.0016 | 0.0018 | 0.0020 | 0.0021 | 0.0023 | 0.0025 | 0.0027 | 0.0031 |
| 1/4 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0011 | 0.0012 | 0.0014 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0024 | 0.0026 | 0.0028 | 0.0031 |
| 17/64 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0011 | 0.0013 | 0.0015 | 0.0017 | 0.0019 | 0.0020 | 0.0022 | 0.0024 | 0.0026 | 0.0028 | 0.0032 |
| 9/32 | 0.0003 | 0 0005 | 0.0007 | 0.0009 | 0.0011 | 0.0013 | 0.0015 | 0.0017 | 0.0019 | 0.0021 | 0.0023 | 0.0025 | 0.0027 | 0.0029 | 0.0033 |
| 19/64 | 0.0003 | 0.0006 | 0.0008 | 0.0010 | 0.0012 | 0.0014 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0024 | 0.0026 | 0.0028 | 0.0030 | 0.0034 |
| 5/16 | 0.0004 | 0.0006 | 0.0008 | 0.0010 | 0 0012 | 0.0014 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0024 | 0.0026 | 0.0028 | 0.0030 | 0.0035 |
| 11/32 | 0.0004 | 0.0006 | 0.0008 | 0.0010 | 0.0012 | 0.0014 | 0.0017 | 0.0019 | 0.0021 | 0.0023 | 0.0025 | 0.0027 | 0.0029 | 0.0031 | 0.0036 |
| 3/8 | 0.0004 | 0.0006 | 0.0008 | 0.0011 | 0.0013 | 0.0015 | 0.0017 | 0.0019 | 0.0021 | 0.0024 | 0.0026 | 0.0028 | 0.0030 | 0.0032 | 0.0037 |
| 13/32 | 0.0004 | 0.0007 | 0.0009 | 0.0011 | 0.0013 | 0.0016 | 0.0018 | 0.0020 | 0.0022 | 0.0024 | 0.0027 | 0.0029 | 0.0031 | 0 0033 | 0.0038 |
| 7/16 | 0.0005 | 0.0007 | 0.0009 | 0.0012 | 0.0014 | 0.0016 | 0.0018 | 0.0021 | 0.0023 | 0.0025 | 0.0027 | 0.0030 | 0.0032 | 0.0034 | 0.0039 |
| 15/32 | 0.0005 | 0.0007 | 0.0010 | 0.0012 | 0.0014 | 0.0017 | 0.0019 | 0.0021 | 0.0024 | 0.0026 | 0.0028 | 0.0030 | 0.0033 | 0.0035 | 0.0040 |
| 1/2 | 0.0005 | 0.0008 | 0.0010 | 0.0012 | 0.0015 | 0.0017 | 0.0020 | 0.0022 | 0.0024 | 0.0027 | 0.0029 | 0.0031 | 0.0034 | 0.0036 | 0.0041 |
| 17/32 | 0.0006 | 0.0008 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0020 | 0.0023 | 0.0025 | 0.0027 | 0.0030 | 0.0032 | 0.0035 | 0.0037 | 0.0042 |
| 9/16 | 0.0006 | 0.0008 | 0.0011 | 0.0013 | 0.0016 | 0.0018 | 0.0021 | 0.0023 | 0.0026 | 0.0028 | 0.0031 | 0.0033 | 0.0036 | 0.0038 | 0.0043 |
| 19/32 | 0.0006 | 0.0009 | 0.0011 | 0.0014 | 0.0016 | 0.0019 | 0.0022 | 0.0024 | 0.0027 | 0.0029 | 0.0032 | 0.0034 | 0.0037 | 0.0039 | 0.0045 |
| 5/8 | 0.0007 | 0.0009 | 0.0012 | 0.0014 | 0.0017 | 0.0020 | 0.0022 | 0.0025 | 0.0027 | 0.0030 | 0.0033 | 0.0035 | 0.0038 | 0.0040 | 0.0045 |
| 11/16 | 0.0007 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0021 | 0.0023 | 0.0026 | 0.0029 | 0.0032 | 0.0034 | 0.0037 | 0.0040 | 0.0042 | 0.0048 |
| 3/4 | 0.0008 | 0.0011 | 0.0013 | 0.0016 | 0.0019 | 0.0022 | 0.0025 | 0.0027 | 0.0030 | 0.0033 | 0.0036 | 0.0039 | 0.0042 | 0.0044 | 0.0050 |

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first coaster brake for bicycles
first yellow taxicab
first monobloc engine
first dual purpose ball bearing
first preloaded bearing
first self-sealed pump shaft bearing
first bearing with oil-circulating system
first self-sealed conveyor roll bearing
first successful treadle roll ball bearing
first "lubricated-for-life" ball bearing
first self-sealed mine car bearing

This company has been pioneering for over fifty years. It is "young enough to venture, old enough to know how." These new departures by New Departure are evidence of the creative ability of its engineers, which is freely at your disposal to improve your machine performance. New Departure, a division of General Motors, Bristol, Connecticut.

# NEW DEPARTURE

**THE FORGED STEEL BEARING**

2954

TIME-DATA SHEET NO. 28

# Sensitive Drill Press Operations—IV

(*Continued from Time-Data Sheet No. 27*)

Recommended cutting speeds in surface feet cut per minute are as follows:

| Material Being Machined | Drilling Speed | Tapping Speed |
|---|---|---|
| Cast steel | 65 | 18 |
| Cold rolled steel | 70 | 20 |
| Malleable iron | 85 | 24 |
| Bronze | 90 | 30 |
| Annealed steel | 85 | 32 |
| Copper | 180 | 35 |
| Cast iron | 100 | 38 |
| Brass | 200 | 45 |

Time in hours for tap to enter or withdraw 1 in. is equal to:

$$\frac{\text{Threads Per Inch}}{\text{R.P.M.} \times 60}$$

Therefore, allowed time (not including allowances for personal necessities, fatigue, cleaning and oiling) for tap to enter and withdraw from a given hole is equal to:

$$T = \frac{P(L+X)}{60S} + 2\left[\frac{L+X}{R} \times \frac{P \times 0.1875}{60S}\right] + \frac{P(L+X)}{60S}$$

Where: $P$ = Number of threads per inch.
$L$ = Length tapped in inches.
$S$ = Speed of spindle in revolutions per minute.
$R$ = Depth tapped before relieving tap by running back $\frac{3}{16}$ in. ($R = \frac{1}{2}$ in. for brass, $\frac{3}{8}$ in. for cast iron or copper, and $\frac{1}{4}$ in. for steel).
$X$ = Length of lead in inches.
$T$ = Base allowed time in hours.

Combining in above formula:

$$T = 2P\left[\frac{RL + RX + 0.1875L + 0.1875X}{60RS}\right]$$

For brass, substituting 0.50 for $R$,

$$T = \frac{0.0458P(L+X)}{S}$$

Adding 15 per cent for personal necessities and fatigue and 2 per cent for cleaning and oiling, allowed time for tapping brass is equal to:

$$\frac{0.0538P(L+X)}{S}$$

For cast iron or copper, substituting 0.375 for $R$,

$$T = \frac{0.0500P(L+X)}{S}$$

Adding percentages, allowed time for tapping cast iron or copper is equal to:

$$\frac{0.0587P(L+X)}{S}$$

For steel, substituting 0.25 for $R$,

$$T = \frac{0.0583P(L+X)}{S}$$

Adding percentages, allowed time for tapping steel is equal to:

$$\frac{0.0685P(L+X)}{S}$$

(*Continued on Time-Data Sheet No. 29*)

**Table No. 3—Drill Cast Iron, Malleable Iron, Copper or Bronze**

| Size of Drill — Inches | DEPTH OF HOLE IN INCHES | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ⅛ | ¼ | ⅜ | ½ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ | 1⅜ | 1½ | 1⅝ | 1¾ | 2 |
| 1/16 | 0.0004 | 0.0007 | 0.0010 | 0.0013 | 0.0016 | 0.0019 | 0.0022 | 0.0025 | 0.0028 | 0.0032 | 0.0035 | 0.0038 | 0.0041 | 0.0044 | 0.0050 |
| 9/64 | 0.0004 | 0.0007 | 0.0010 | 0.0014 | 0.0017 | 0.0020 | 0.0023 | 0.0026 | 0.0029 | 0.0032 | 0.0035 | 0.0039 | 0.0042 | 0.0045 | 0.0051 |
| 5/32 | 0.0004 | 0.0008 | 0.0011 | 0.0014 | 0.0017 | 0.0020 | 0.0024 | 0.0027 | 0.0030 | 0.0033 | 0.0036 | 0.0039 | 0.0043 | 0.0046 | 0.0052 |
| 11/64 | 0.0005 | 0.0008 | 0.0011 | 0.0014 | 0.0018 | 0.0021 | 0.0024 | 0.0027 | 0.0031 | 0.0034 | 0.0037 | 0.0040 | 0.0044 | 0.0047 | 0.0053 |
| 3/16 | 0.0005 | 0.0008 | 0.0011 | 0.0015 | 0.0018 | 0.0021 | 0.0025 | 0.0028 | 0.0031 | 0.0035 | 0.0038 | 0.0041 | 0.0045 | 0.0048 | 0.0054 |
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| 7/32 | 0.0005 | 0.0009 | 0.0012 | 0.0016 | 0.0019 | 0.0023 | 0.0026 | 0.0029 | 0.0033 | 0.0036 | 0.0040 | 0.0043 | 0.0047 | 0.0050 | 0.0057 |
| 15/64 | 0.0005 | 0.0009 | 0.0012 | 0.0016 | 0.0020 | 0.0023 | 0.0027 | 0.0030 | 0.0034 | 0.0037 | 0.0041 | 0.0044 | 0.0048 | 0.0051 | 0.0058 |
| 1/4 | 0.0006 | 0.0009 | 0.0013 | 0.0016 | 0.0020 | 0.0024 | 0.0027 | 0.0031 | 0.0034 | 0.0038 | 0.0041 | 0.0045 | 0.0049 | 0.0052 | 0.0059 |
| 17/64 | 0.0006 | 0.0010 | 0.0013 | 0.0017 | 0.0021 | 0.0024 | 0.0028 | 0.0031 | 0.0035 | 0.0039 | 0.0042 | 0.0046 | 0.0050 | 0.0053 | 0.0060 |
| 9/32 | 0.0006 | 0.0010 | 0.0014 | 0.0017 | 0.0021 | 0.0025 | 0.0028 | 0.0032 | 0.0036 | 0.0039 | 0.0043 | 0.0047 | 0.0051 | 0.0054 | 0.0062 |
| 19/64 | 0.0006 | 0.0010 | 0.0014 | 0.0018 | 0.0022 | 0.0025 | 0.0029 | 0.0033 | 0.0037 | 0.0040 | 0.0044 | 0.0048 | 0.0052 | 0.0055 | 0.0063 |
| 5/16 | 0.0007 | 0.0011 | 0.0014 | 0.0018 | 0.0022 | 0.0026 | 0.0030 | 0.0033 | 0.0037 | 0.0041 | 0.0045 | 0.0049 | 0.0053 | 0.0056 | 0.0064 |
| 21/64 | 0.0007 | 0.0011 | 0.0015 | 0.0019 | 0.0023 | 0.0027 | 0.0031 | 0.0035 | 0.0039 | 0.0043 | 0.0047 | 0.0051 | 0.0055 | 0.0059 | 0.0066 |
| 3/8 | 0.0008 | 0.0012 | 0.0016 | 0.0020 | 0.0024 | 0.0028 | 0.0032 | 0.0036 | 0.0040 | 0.0044 | 0.0049 | 0.0053 | 0.0057 | 0.0061 | 0.0069 |
| 13/32 | 0.0008 | 0.0013 | 0.0017 | 0.0021 | 0.0025 | 0.0029 | 0.0034 | 0.0038 | 0.0042 | 0.0046 | 0.0050 | 0.0055 | 0.0059 | 0.0063 | 0.0071 |
| 7/16 | 0.0009 | 0.0013 | 0.0018 | 0.0022 | 0.0026 | 0.0031 | 0.0035 | 0.0039 | 0.0044 | 0.0048 | 0.0052 | 0.0057 | 0.0061 | 0.0065 | 0.0074 |
| 15/32 | 0.0009 | 0.0014 | 0.0018 | 0.0023 | 0.0027 | 0.0032 | 0.0036 | 0.0041 | 0.0045 | 0.0050 | 0.0054 | 0.0059 | 0.0063 | 0.0068 | 0 0076 |
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| 11/16 | 0.0014 | 0.0019 | 0.0025 | 0.0030 | 0.0035 | 0.0040 | 0.0046 | 0.0051 | 0.0056 | 0.0062 | 0.0067 | 0.0072 | 0.0077 | 0.0083 | 0.0093 |
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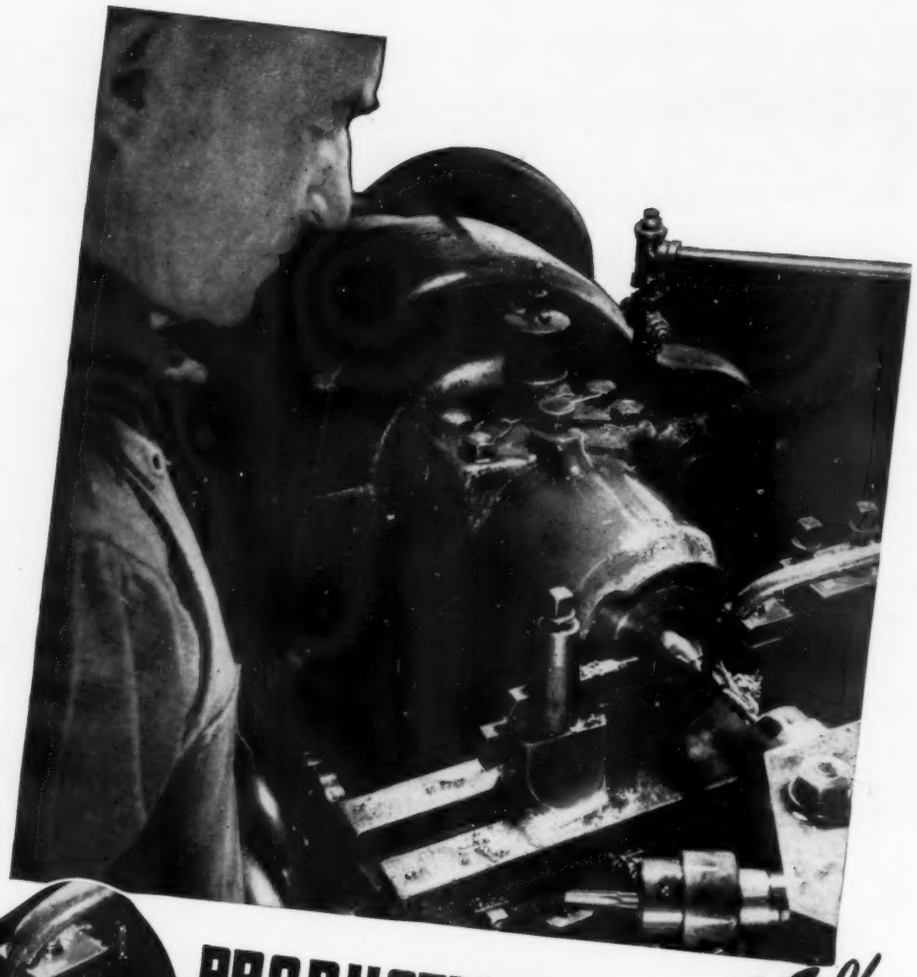


# PRODUCTION: *Up 50%*

A certain New Jersey manufacturer reports this very good saving in tapping costs. This screw machine is turning out a part made of 3½% nickel steel. Tapping a ⅜-24 hole was the "bottleneck" of the job until they switched to "G. T. D. Greenfield" Taps. The solution recommended was a roughing cut with a *"Gun"* Tap and the last .010 of an inch removed by a ⅜-24 High Speed Steel Ground Thread "G. T. D. Greenfield" Tap. Production on the whole job jumped 50%.

To manufacturers everywhere who must use every possible means of increasing production, we say—"Have you thoroughly investigated 'G. T. D. Greenfield' Taps? —Ground Thread High Speed Steel for fast, accurate work; *'Gun'* Taps for 'through holes'; *'Maxi'* (the special surface treatment) for stringy or abrasive materials." "G. T. D. Greenfield" Engineers will arrange a test at your convenience.

GREENFIELD TAP & DIE CORP., GREENFIELD, MASS.

Detroit Plant: 2102 West Fort Street
Warehouses in New York, Chicago, Los Angeles, San Francisco
In Canada: Greenfield Tap & Die Corporation of Canada, Ltd., Galt, Ont.

G T D GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

# How Good Are They?

"BITS AND PIECES" is what Britain calls her program for putting into use all idle or partially idle machines on defense work. Planes and munitions parts are literally made in bits and pieces to be assembled later at centralized factories.

Germany has a similar scheme and is said to be utilizing electrified farms to make munitions items. Every possible mechanical resource is being mobilized for the war effort.

Adoption of the farming out scheme for our own defense production is logical. Cumbersome machinery cannot be moved from one plant to another merely because one company has a government contract and a second firm doesn't. How much more intelligent for the one company to have the second company make some of its parts and subassemblies.

We shouldn't be lulled into thinking, however, that this farming out plan, no matter how extensively applied, is a cure-all for delays. It will speed up the job, but not beyond a certain point. For beyond that point it is impossible to substitute anything else for time itself.

Surveys being made of idle machine capacity around the country are immensely helpful, but we shouldn't let our hopes soar too high. The number of idle machines turned up is impressive, but the question is how good they are.

A metal-working plant is more than a building with a lot of machines in it. For one thing, good management is essential. It also must possess machines in good condition.

If the machines are in poor shape, they are of doubtful value for the defense task. With the single exception of shell, practically every item of munitions that we are to make calls for closer limits than a 1929 machine tool, which has been abused and has not been maintained, could possibly meet.

This is being said not in discouragement of the farming out system, which offers the soundest method of quickening our productive pace, or of the surveys which already have uncovered idle capacity which can and should be put to work, but in the belief that we shouldn't expect the impossible.

Let's be realistic. No miracles are about to happen. No miracles can happen. If we clearly accept that premise, we won't be disappointed if six months from now we are not building 500 planes a day, as all of us wish we could.

Burnham Finney

# GAGING BUSINESS

**Machine tool expansion hampered by reluctance of workmen to go on a third shift. British in market for $280,000,000 of machine tools. Funds requested for stand-by munitions plants**

**Machine Tools**—Machine tool builders still expect to be able to push their production this year up to $650,000,000 from the 1940 level of $425,000,000. Expansion of output is being hampered somewhat by the reported reluctance of workmen to go on a third shift. Many plants, however, are working three shifts, and almost all companies are on two long shifts. Physical plant expansion continues at a good rate. Gisholt Machine Co., for one, will reopen its northern works at Madison, Wis. Farming out of parts and sub-assemblies is growing, though a few companies have already gone the limit. The British are expected to come into the U. S. market for $280,000,000 of machine tools on top of gigantic orders heretofore placed. A large percentage of those machines will be for delivery to American firms with British contracts, to Canada and to other portions of the Empire outside England itself. Most urgent domestic need is machine tools for plants to build machine guns. Production of machine guns is likely to lag behind airplane assemblies. Orders for $6,250,000 of machine tools and other equipment for Westinghouse's new ordnance factories at Louisville and Canton have been let, and $6,000,000 more of machine tool awards are looked for. Soviet government agencies in this country are trying hard to secure machine tools for early shipment, but are not having much success.

**Munitions**—The War Department is asking Congress for $1,600,000,000 for guns, tanks and other material to round out equipment for an army of two million men and $400,000,000 for construction of additional munitions plants to give the country sufficient reserve capacity to supply land forces of four million men in an emergency. The new plants would be on a "stand-by" basis similar to Britain's shadow plants prior to the war. The British also are planning to expend a billion or more for munitions in this country. Westinghouse will build and operate for the government a $5,000,000 navy ordnance plant at Louisville, Ky., and a $16,000,000 ordnance factory at Canton, Ohio. Louisville plant will assemble gun mounts, gun slides, recoil mechanisms, breech housings and breech blocks. Much of the machining will be done at Canton. Danly Machine Specialties Co., Cicero, Ill., will build $5,500,000 of naval anti-aircraft gun mounts.

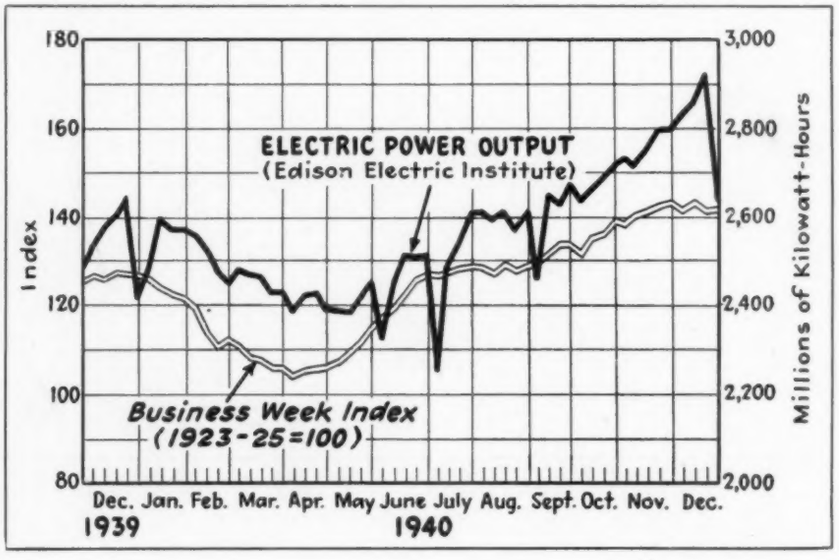
**Construction Machinery**—Construction equipment makers, particularly tractor companies, are working at top speed to meet the demand for industrial equipment as a result of construction of airports, new army camps, roads and housing projects on top of industrial and private building. Practically no equipment is available for rent and not much used machinery is on the market.

**Shipbuilding**—Employment in shipbuilding and ship repair yards has increased 45 per cent the last year. All the country's private yards are running at or near capacity. Thirty-four companies are now building sea-going vessels. It is believed that further enlargement of shipbuilding facilities can best be accomplished by development of existing organizations rather than by creation of new firms. This policy was followed in connection with the British order for $100,000,000 of tonnage which went to new yards of Todd Shipbuilding Corp., in conjunction with yards in Maine and California. Great Lakes yards are constructing submarines and various types of smaller navy ships.

**Railroad Equipment**—New York Central's $5,000,000 outlay for 95 passenger cars and 2,000 freight cars plus a recent order for 36 diesel switchers finished up the best year for railway equipment makers since 1929. Total freight car bookings during 1940 were close to 63,000 units, passenger cars 370 and locomotives 560.

**Steel**—Ingot operations continue at 95 per cent and will stay close to full capacity for some months. Steel people are confident they can take care of all defense needs without any serious delays. They anticipate that Britain's requirements will grow as plants in England may be put out of action by bombs and as other parts of the Empire step up their armament production.

**Aircraft**—Current production is reported to be 700 airplanes and 2,400 engines a month. About 250 to 300 combat planes are being built monthly. Probably the most important reason for aircraft output being behind schedule is that the industry as a whole has been going through what amounts in the automobile field to a model change. Studebaker will make Wright 1,800-hp. engines at new plants to be erected at South Bend, Fort Wayne, Ind., and Chicago. The Chicago factory will manufacture special airplane engine parts to be assembled at South Bend and will employ 4,000 men. Buick will construct a new plant at Grand Blanc, Mich., a few miles south of Flint, where Pratt & Whitney motors will be made. North American Aviation is to increase its facilities for making airplane frames at cost of $2,270,405.



# U. S. PLANE PRODUCTION FAR BEHIND SCHEDULE

**Rate falls to 700 per month after reaching a level of 900 last August. Knudsen aimed at 1250 planes monthly by January 1941**

BY ROBERT COLBORN

WASHINGTON—Military aircraft production goes into the new year far behind schedule, with no clear-cut reasons known for the failure, and no sure-fire remedies in sight.

Production is now at the rate of 700 combat ships and trainers per month, having dropped from a level of 900 last August. Of the 700 per month, 250 to 300 are combat craft, the largest number being Curtiss P-40s, something like 200 a month. About 15 each of Boeing and Consolidated 4-engine bombers are coming out each month.

The schedule that Mr. Knudsen aimed at was 1250 a month by January 1941; 1500 a month by June; and 3000 a month by June 1942. No one is willing to admit that we will not catch up with the schedule and make up for lost production. Most persons responsible for the aircraft program, in the industry and in Government, are surprised at the failure; few are dismayed. In fact there is no rational basis for dismay, since there is no record of any better aircraft production elsewhere. Germany took five or six years to build up her productive capacity. Britain staged a miraculous improvement last year, but going from very bad to better is an easy trick. The public is disappointed, but the political effect of this would not show for a while yet.

**Model Changes Hamper Production**

Reasons why the schedule wasn't met have not been nailed down. However one or all three causes possibly will be revealed when the fog lifts.

First, the industry as a whole is going through what amounts in the auto field to a model change. For example, Martin is switching from the French bomber to the British "Baltimore" and the US Army B-26. Lockheed is changing from the Hudson to a more advanced bomber, meanwhile trying to get going with the P-38E. North American is just putting the B-25 into full production; is still setting up a line for its pursuit ship. Republic has just changed over from the Swedish P-35 to the "Lancer" and will soon switch again to the P-44—and there are others.

Second, an enormous volume of unskilled labor is being fed into the plants to be trained while in production. This kind of thing might drag on production without being readily visible. If lack of skill is an important factor it will continue until plant expansion stops.

Third, the business of plant expansion itself is taking a lot of executive attention and skilled work that otherwise would be pushing production.

And it may be assumed that the current suspicion that a shortcut to miraculous outpourings of planes will be found, such as letting the auto people do it, has been a distraction.

What is to be done about the problem no one can say. The CIO proposal to use vacant auto plant facilities is being seriously considered. Chances are that estimated production will be achieved the hard way, a step at a time, with no sensational discoveries.

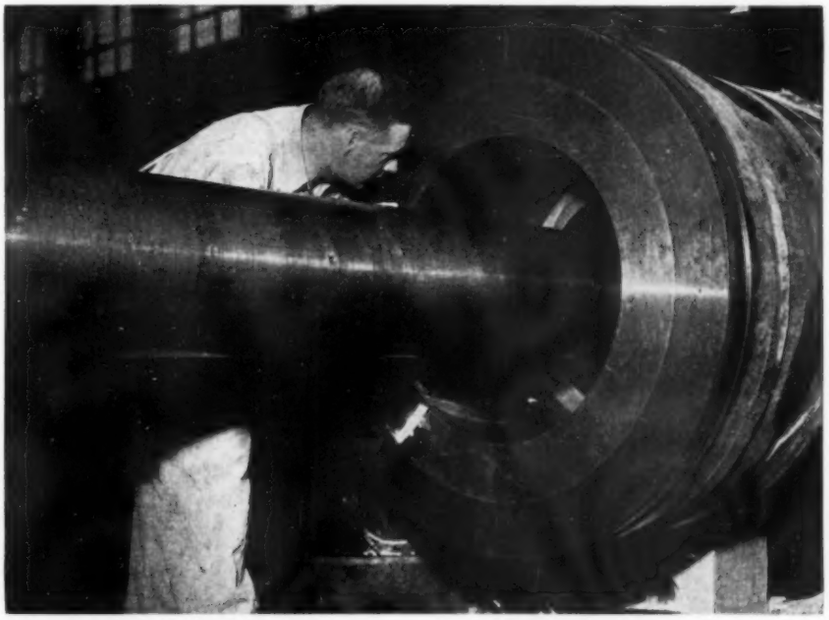
Division of plane production between the U.S. and Britain is a military secret, but it may be assumed that Britain is getting practically all but the trainers. Many of the big planes are being flown from Canada across the Atlantic. If and when Britain might appear to be nearing collapse this Government would have a perplexing problem to decide when to stop export and hold the planes for our own defense.

Our own air arms probably are gaining very little combat equipment. Last July the Air Corps had about 3000 planes of which 1100 were combat, 800 trainers, 1100 miscellaneous. Navy had about 1367 combat, 288 trainers, 158 others. Air Corps says it will complete its original 5500 quota (which no longer exists; the limit is off) in the Spring. But that depends on whether production goes up to schedule, and on what happens abroad.

As to foreign air forces, some observers now believe that Hitler never had the air force he claimed at the war's beginning; his raids don't show it. But most agree that he is going great guns now, with his own and French and Czeck plants and plenty of materials at his disposal. He might have up to 50,000 planes this spring, not less than 30,000. The British probably have between 12,000 and 20,000. Obviously the Italian air force was grossly oversold or it is out of oil.

## NLRB HAMPERS DEFENSE

WASHINGTON—The Smith Committee surprised no one by winding up its long investigation of the National Labor Relations Board with the charge that NLRB has jeopardized national defense production and the fundamental concepts of the government. Amendments to the Labor Act, which failed in the last Congress, have only a small chance in the Seventy-Seventh. If a wave of strikes occur in defense industries, however, the administration would be moved to restrictive action, probably in the form of no-strike legislation rather than in amendments to the labor act.



**Big Guns Protect the U.S.**—*Not only are political "Big Guns" working to insure U.S. defense, but Government arsenals are speeding production of the real thing. At Watervliet (above) a workman supervises the last boring operation in an assembled major caliber gun*

# National Defense Problems Discussed at SAE Annual Meeting; Colwell is New President

DETROIT—Top Army and Navy officials, Defense Commissioner William Knudsen, and Sir Louis Beale of the British Purchasing Commission are among the featured speakers who will picture the urgency of the present situation at the remaining national defense sessions of the Annual Meeting of the Society of Automotive Engineers being held at the Book-Cadillac Hotel this week. Technical sessions at the meeting are featuring defense problems in addition to current problems faced in design, production and maintenance of automobiles, aircraft, trucks, and buses, as well as in fuels and lubricants.

In the first sessions of the week B. B. Bachman, Autocar Co., presented the SAE's National Defense Program; and Major General E. B. Gregory, Quartermaster Corps., told of the problems of Motor Transportation in National Defense. At a Thursday session Eugene H. Fezandie, associate professor, Stevens Institute of Technology, will present a paper describing the "Status of the Automotive Diesel," in which he concludes that the automotive diesel has every expectation of large increases in adoption in many fields, and that all the general classes of design will probably share in this increase. Lower specific weights will be obtained, for all classes, said Mr. Fezandie, through special materials and the reduction of overall dimensions for a given power.

K. T. KELLER

Other technical papers were presented by S. J. Loring, Vought-Sikorsky Aircraft, who outlined the general approach to the flutter problem, and by A. L. Boegehold, General Motors Corp., who described the use of hardenability tests for selection and specification of automotive steels. Mr. Boegehold named the following factors as affecting the hardenability of steel: Temperature to which steel is heated; prior treatment affecting condition of carbides; rate of heating below critical temperature; composition; grain size; carbide condition and little understood factors inherited from steel making process. "It will be seen," he continues, "that a slight change in the hardness requirements specified for the piece to be hardened makes a great difference in the variety of steels that will meet those requirements."

K. T. Keller, president, Chrysler Corp., will preside over the Production session of the meeting tomorrow, January 9. At this session William Knudsen will lead an "off the record" discussion on special problems in mass production of automotive defense equipment.

A. T. Colwell, Thompson Products, was elected president of the Society for 1941. David Beecroft, Bendix Aviation Corp., was elected treasurer. Mac Short, Vega Airplane Co., was elected vice president of aircraft engineering, and E. S. Chapman, Plymouth Division, Chrysler Corp., was elected vice president, production engineering. Karl M. Wyse was named vice president in charge of passenger car engineering.

### KELLER SEES CAR SHORTAGE

DETROIT—K. T. Keller, president Chrysler Corp., says that "we must expect that production of defense materials will quite likely affect the volume of new passenger car and new truck production for domestic use. It is hoped that a reasonable volume of domestic production can be maintained."

# $3,000,000,000 More Sought For U.S. Defense Work

WASHINGTON—If the new Congress, which convened last week, has not already been asked to appropriate $3,000,000,000 for more items in U.S. defense, it soon will be asked to do so. The amounts to be asked include: $1,000,000,000 for the production of 3,600 more bombing planes from parts made largely in existing automobile factories and assembled in four midwestern plants operated by aircraft companies; $1,600,000,000 for guns, tanks, planes and other material for 2,000,000 men; $400,000,000 for the construction of additional munitions plants to give the country sufficient reserve capacity to supply land forces of 4,000,000 men.

Plans call for the maintenance of munitions factories on a stand-by basis, similar to the role of the British "shadow plants." These would be in addition to the 84 factories provided for under the $800,000,000 appropriated by Congress last summer.

The new request for funds will raise the total national defense expenditures beyond $20,000,000,000 since the beginning of 1940. About 75 per cent of the $6,600,000,000 appropriated for the Army last year has already been obligated and, in so far as new munitions facilities are concerned, all but five per cent of the available funds are obligated. The first of the new powder plants built under this program is scheduled to come into production in June, or possibly sooner. In addition, more than $5,000,000,000 of production for the British is pending or in prospect, part in British cash, and part under the President's lease-lend program.

# British Orders Aid U. S. Shipbuilding; U. S. Maritime Program Almost Doubled

WASHINGTON—Two huge merchant shipbuilding programs have come over the horizon. The Todd Companies' order for sixty 10,000-ton freighters, one of the world's biggest, is only the beginning of a British construction project in this country. The other is the expansion of the U.S. Maritime Commission's 50-ships-a-year schedule to double or more what it is now. If the President succeeds in selling to Congress his plan for lending implements of war to England, probably the two shipbuilding projects would be merged eventually, this government placing all orders.

The Administration would have some difficulty getting Congress to aid Britain with merchant ships right now, because the Empire is still maintaining service on many of its world trade routes, in potential competition to the expanded sea commerce the U.S. hopes to accomplish under its ship subsidy program which has cost about $500,000,000. As previously pointed out by AMERICAN MACHINIST the British are maneuvering to keep the Union Jack on the sea lanes after the war even if we build the ships.

Evidently the Todd order for 60 vessels was financed by the British, out of $100,000,000 allocated for yards expansion and shipbuilding. Boilers for the ships may be manufactured by Babcock & Wilcox Co., New York. Some observers indicate that 2,800 h.p. reciprocating engines will be used in the ships.

When Britain's ship shelves are bare, she has nowhere to turn but to the U.S., which also is running low on tonnage. Already we have sold 37 of the Maritime Commission's laid-up fleet to Britain, who undoubtedly will get the additional 24 which are up for sale, a total of 61. Only 20 bottoms are left in our ghost fleet. These are being reconditioned, apparently for our own use.

# Appoint Trecker Brothers to Advise Defense Commission on Sub-contracting Methods

MILWAUKEE—Joseph L. Trecker, vice-president, and Francis J. Trecker, assistant chief engineer, Kearney & Trecker Corp., have been selected by the U. S. War Department as special advisers on "farming out" methods for national defense work. Joseph Trecker will devote three days a week to the defense program, and his brother, Francis Trecker, will give his full time. Both will serve as dollar-a-year men. This move has been made to get the defense load spread as widely as possible and to take advantage of the skills and machinery in many small shops which cannot, because of size or type of tools, handle prime contracts.

Known in England as the "bits and pieces" policy sub-contracting was put to use by the British late in 1938 when the aircraft industry was asked to sublet a minimum of 35 per cent of its work on government orders. Prior to that time the British had relied on construction of new factories and expansion of existing plants. Vickers is said to be utilizing about 700 small machine shops in many parts of England.

### Successful In The Past

Having successfully farmed out some 30 per cent of their work while also expanding their own plant employment from 1,400 men in 1939 to about 3,200 men at the present time, the Treckers have ample experience and background for handling the national job of encouraging the use of subcontracts by holders of prime defense contracts. In the aggregate, shops of small size represent an appreciable portion of the nation's productive capacity. By proper coordination and use of their facilities this potential capacity can be put to work immediately.

Sub-contracting is, of course, not a new idea in this country having been used by machine tool and other manufacturers in the past. However, the larger scale operations which began with large French and British orders about sixteen months ago brought the number of sub-contractors for Kearney & Trecker to about 70 to 80 machine shops and 12 to 14 foundries. Two companies are making complete machines, contracting for their own castings and materials.

Other companies are making parts suited to their plant abilities and available capacities. American Can, for example, is doing work in several of its shops for Kearney & Trecker. United Shoe Co. is making arbors. Saranac Automatic Machine Corp. is making all of the parts for one model which are then assembled at the company plant in Milwaukee. With a few exceptions the remainder of the subcontracting shops have an employment of 75 men or less.

Roughly the plan of handling subcontracts is as follows: The production and planning department of Kearney & Trecker schedules its requirements for 12 months in advance. Wherever the schedule indicates that there will be a shortage of certain items the sub-contracting department is called in and asked to arrange to meet the schedule requirements in these items. The sub-contracting department after investigation of the outside shops issues an order with specified delivery dates for the items. These orders are given to shops which have been investigated as to available machines, type of men employed, ability to deliver quality goods.

Formerly headed by Francis Trecker, the sub-contracting department generally makes contact with prospective suppliers by letter or through the sales organization. The prospective supplier furnishes a list of available equipment giving type, age and condition. Upon investigation of the type of work the employees are capable of doing and the suppliers ability to deliver depends final letting of the order. When it is discovered that a supplier has a capacity beyond that required by a certain production order, the production department is informed. Thus if there are several suppliers with additional capacity available the production department can up its schedule to suit.

Since it is important to maintain quality of work not only from the standpoint of customer satisfaction and company reputation but also in the best interests of national defense constant inspection is maintained by a staff of engineering and technical personnel. These men coordinate the activities of the sub-contractor and check on the quality and accuracy of work being done. Where large sub-contracts have been let men will be assigned permanently to the particular plant. Traveling inspectors cover the plants with smaller contracts regularly.

Another point of importance in this work is that the designs have not been changed to suit the facilities of contracting shops. In every case the shop was selected so that no changes in design had to be made. With their own technical men to assist sub-contractors in planning and supervision, production control and inspection Kearney & Trecker has been able to farm out some 30 per cent of its work without impairment of the quality of the product. In fact, in many small shops they have found that the mechanics are extremely skillful with the equipment at hand and in many cases are better all around machinists than those found in large plants.

## AIRPLANE ENGINE CONTRACTS

WASHINGTON—Buick Motor Co. and Studebaker Corp. will begin production soon of air-cooled airplane engines for the U. S. War Department. These companies will build new plants under a facilities contract by which the government will repay to the companies the cost of the plant over a period of five years. The government will take title to the plants at the end of that time. Studebaker Corp. will build Wright "2600" engines at South Bend, Ind., Fort Wayne, Ind., and at Chicago. The new plant which will be built by Studebaker Corp. is estimated to cost $36,799,000. Buick Motor Co., which will build Pratt & Whitney "1830" engines, is scheduled to erect a $24,313,000 plant at Grand Blanc Township, Mich. Contracts for the actual production of the engines have not yet been signed but are being negotiated.

*Appointed Special Advisers on Sub-contracting*

FRANCIS J. TRECKER

JOSEPH L. TRECKER

# Almost 100 Per Cent of Canadian Armament Production Goes to Britain; Planes Delayed

MONTREAL—A far-reaching shift in war emphasis is now taking place in Canada. Heretofore Canada has geared her munitions production effort to a long-term program which was designed to reach a maximum efficiency in 1942. Recently the urgency of help to Britain in the next three to six months has superseded the long-time plan. It is realized that Germany will launch an "all-out" campaign this spring to end the war victoriously before sufficient help can be secured by Britain. Under the circumstances the thing which will count the most will be the assistance given in the first half of 1941.

Minister of Munitions and Supplies Howe is now in England for the sole purpose of getting from the British government the requirements of planes and other war goods from Canada for the period immediately ahead. As soon as agreement is reached on how much Canada actually can furnish, Mr. Howe will return to Canada and set in motion at once the machinery to make what is needed. Thus a great speed up in war activities is looked for soon.

**More For Britain**

One change already brought about by the shift in emphasis to Britain's immediate needs is the allotting of almost all of munitions production to England rather than reserving half of it for Canada's own forces at home. This policy of sending almost 100 per cent of the output to Britain will be continued indefinitely.

Despite the determination to give all possible help to Britain, things aren't going as well as they might. Production of Avro-Anson twin-engine bomber training planes, for example, is reported delayed because of inability of manufacturers to get essential parts. Considerable bickering is said to exist between Federal Aircraft Ltd., a government-owned company assigned the task of getting Ansons into production, and private companies supplying parts and materials. Federal Aircraft's management claims lack of cooperation by private companies, whereas the latter insist that the government company has been arbitrary and has gone so far as to entice away some of their best technical men to set up a plant and show the airplane companies how fast and easily the job can be done. The result is quantity production is not likely until the middle of 1941.

Friction between various companies and the government dollar-a-year men has become more general, is greatest in the aviation industry. To avoid criticism the government has assigned its dollar-a-year executives to supervise industries in which they have no financial stake.

A clause which the government is now inserting in war contracts has aroused the particular protests of manufacturers. It provides that the government may audit a company's books at any time, and if "in the opinion of the Minister (of Munitons and Supply)," the profit being made is considered more than "fair and reasonable," the government can adjust downward the price which it is paying. Industrialists are protesting because there is no appeal from the "opinion" of the Minister, and because the audit may be for any period of time.

Meanwhile war orders are continuing. Contracts for 12 additional minesweepers have been let and will be built at North Vancouver and at the Dufferin Shipyards, Toronto. Contracts now placed for 120 naval boats total $80,000,000. Half of the ships have been completed, machinery and equipment is now being installed.

The stability of wages in Canadian war industries is expected to result from a government order-in-council. This rules that concilation boards, appointed to arbitrate wage disputes, are to permit higher pay only in the form of bonuses which will be tied to the government cost-of-living index. The wage "standard" will be the figure of average wages during 1926-29. The "standard" will be the minimum to which bonuses are to be added.

The following contracts have been awarded recently by the Department of Munitions and Supply:

Aircraft: Fleet Aircraft Ltd., Fort Erie, Ont., $2,900,000; Noorduyn Aviation Ltd., Montreal, $3,000,000; De-Havilland Aircraft of Canada, Ltd., Toronto, $646,673; Canadian Vickers, Ltd., Montreal, $480,000; and Canadian Pratt & Whitney Aircraft Co., Ltd., Longueuil, Que., $79,665. Machinery: Dominion Engineering Co., Ltd., Montreal, $86,330; and Fairchild Aircraft Ltd., Longueuil, Que., $45,928.

## Weaver and Gavert Manage Westinghouse Ordnance Plants

EAST PITTSBURGH, PA.—J. R. Weaver, formerly director of equipment, inspection and test at the East Pittsburgh Works, Westinghouse Electric Co., has been appointed manager of the new $5,000,000 ordnance plant at Louisville, Ky. R. V. Gavert, formerly manager of manufacturing, Westinghouse Division, Sharon, Pa., has been appointed manager of the new $16,000,000 ordnance plant at Canton, Ohio. Both plants will be operated for the navy. A. P. Craig has been appointed executive assistant in the Emergency Products Division.

### GRINDING WHEELS AMPLE

NEW YORK—The grinding wheel industry has ample reserve manufacturing facilities so that it can keep well ahead of defense production schedules, according to a survey made by the Industry Defense Committee of the grinding wheel industry. The Grinding Wheel Committee has met with the tool section of the National Defense Commission and has worked out and put into operation a plan of cooperation which will insure an adequate flow of wheels and other abrasive tools not merely in known volume, but specifically in shapes and sizes required by individual manufacturers to produce the items contracted for and planned as future production. The grinding wheel industry has at present 82 per cent excess productive capacity over its present rate of operation. On six-months' notice the all-time peak output of the industry can be exceeded by 101 per cent. Grinding wheel users are being assured that their needs will be met.

## GAGE BLANKS STANDARD

WASHINGTON—A new Commercial Standard for Gage Blanks, identified as CS8-41, is effective as of January 1, 1941 for production, and as of January 1, 1942 for clearance of existing stocks. A memeographed copy, TS-2985, of the accepted standard may be had by specific request from the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C.

## Head Resistance Reduction, Important Advance in Aviation

WASHINGTON—Reduction of head resistance of radial air-cooled airplane engines to a point where their drag is no greater than that of liquid-cooled in-line engines is cited by Prof. J. C. Hunsaker of MIT as the most important aeronautical advance of 1940. He referred specifically to two air-cooled engines of more than 2,000 hp. and he predicted that these and similar engines would give the U.S. a definite edge over any enemy. Prof. Hunsaker, who is a member of the National Advisory Committee for Aeronautics, said that this country's aero advances during last year give us the potential power to produce a new type of war plane that will obsolete all other fighting planes here and abroad. He did not reveal the nature of these advances. In support of Hunsaker's statements concerning speed with air-cooled engines, government authorities said they believed the new Vought ship-board fighter, which is powered with an air-cooled engine, is the fastest plane in the world.

# INSIDE DETROIT

**Reuther's plan to utilize idle capacity of automotive industry to produce 500 planes daily seems impractical from technical standpoint. Plane output now delayed by shortage of materials**

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Labor's plan to utilize the idle capacity of the automobile industry for production of 500 pursuit planes daily within six months does not appear practical from the technical standpoint. Walter P. Reuther, author of the plan, and director of the General Motors department of the UAW-CIO, asserts that "a careful survey will show that the automobile industry as a whole is not using more than 50% of its maximum potential capacity if that capacity were properly coordinated and operated to the fullest degree." He bases this claim upon the results of a union investigation of idle plant facilities during the present peak operation of the industry.

### Idle Machinery Cited

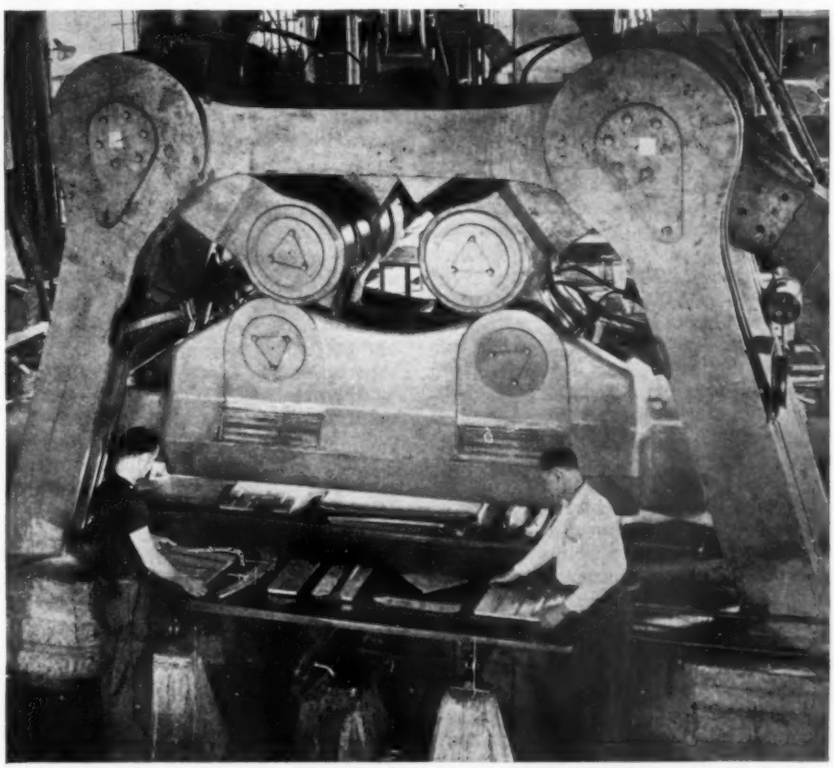
Such idle machinery falls into basic types, the same as used in plane and engine plants, and can be retooled in six months' time, says Mr. Reuther. Why wait eighteen months to procure and tool up the same types of basic machinery in projected plane and engine plants, when the automotive industry can fill the breach in one-third the time? Labor pledges its wholehearted cooperation in the task of utilizing idle automotive machinery and men in exchange for a voice upon matters of policy and administration through representation on a projected nine-man aviation production board.

The Reuther plan overlooks certain facts: (1) the government wants bombers, not pursuit ships, from the automobile industry; (2) the auto industry pledged its resources to the bomber-program two months ago, and has co-ordinated its effort through the Auto Committee for Air Defense, which is actively surveying available facilities of 1000 plants for plane parts production; (3) Detroit has changed its mind about the ease with which auto techniques and equipment can be adapted to plane production; (4) the raw-material situation is already pressing and promises to be critical at a production level of 1000 planes per month, and expansions underway could not care for production of 500 pursuits per day, even if they were wanted by the Army; and (5) the importance of press work and machining (to be done with idle automotive equipment) is greatly over-rated in comparison with number of productive hours expended in building planes.

One of the chief factors preventing the aviation industry from getting above the current output of 700 planes per month is the shortage of aluminum-alloy materials and stainless steel. The present output of aircraft-type sheet aluminum alloy is running about 7,000,000 lb. per month, an amount sufficient for about 1000 pursuit planes, plus spare parts. But aviation men assert that allocation of material under the present priorities system is unsatisfactory, with the result that some plants lack vital material. Orders placed eleven months ago for forged aluminum parts are only partially filled and nothing has been received upon later and larger contracts. Extruded aluminum shapes, ordered in October for ten weeks delivery, will not be shipped in less than seven months. Present capacity for aircraft-grade aluminum castings is considered equal to 60 per cent of next spring's demand. Stainless steel requires nine months delivery.

## PLANE SUB-CONTRACTORS

DETROIT—Final approval is expected soon of a War Department plan whereby Chrysler, Ford and General Motors will each act as a main sub-contractor to the three plane manufacturers involved in the bomber program assigned to the automotive industry. Under the plan General Motors would be responsible for production of parts and sub-assemblies for the North American B-25 two-engined bomber. Guarded comment indicated that GM will go through with the plan even though the other two do not, because North American Aviation is controlled by the motor manufacturer. Chrysler would act in the same category for Martin on the Model B-26 two-engined bomber. Ford personnel were to visit Consolidated Aircraft last week to discuss plans in connection with the Model B-24 four-engined ship. Both Chrysler and Ford have been active in studying the exhibit of the Auto Committee for Air Defense, which features the Martin and Consolidated designs. It is believed now that the Auto Committee for Air Defense will continue to function, even though this deal goes through wholly or in part.



*Courtesy North American Aviation, Inc.*

**Aircraft Stamping**—*Press work of aluminum parts consumes less than 2 per cent of total productive man-hours spent in building a plane. In sharp contrast to automotive methods, this toggle type hydraulic press is fitted with low-production tooling for making a number of pieces at once, and the machine is not kept in constant use*

British Combine

**Britain Presents Arms**—*The heavy Besa gun is capable of firing 450 rounds of ammunition per minute while the light Besa fires 850 rounds in the same time. Both types are used in tanks. In English factories (above) men are constantly inspecting the guns in the works*

## MAY ORDER STEEL EXPANSION

WASHINGTON — The Defense Commission is seriously considering ordering government-sponsored steel ingot capacity expansion, though the industry contends such expansion is not necessary and though some high-placed defense officials agree with the industry. Steel manufacturing representatives believe the administration is unreasonably excited about the supply of steel for fiscal 1942.

With the industry running at capacity, steel authorities estimate that the industry can produce 16,000,000 tons more in 1941 than it did in 1940. That increase would almost equal the 17,000,000 tons needed for home and British defense. The industry complains it is being told how much it must produce, but is not being told how the government arrives at its figures. Some government officials feel that destruction of British mills, plus a war involving the U. S., might require more steel than now in mind.

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It is true that producers of raw materials are expanding facilities but aviation men are inclined to question whether government activity in the raw material field has had the proper relationship to the huge plane contracts let in the last few months. They assert that even though aluminum production is doubled, it will take several months for the material to progress through the various stages from the mill into the finished plane.

The aviation industry doubled its floorspace in 1940, will double present capacity to 45,000,000 sq. ft. in 1941. Fears are expressed that the new facilities will not be able to operate at the planned rate, despite doubling of aluminum production for example. And the bomber project assigned to the automobile industry must also be considered. In view of these circumstances, men who have spent their lives with the aviation industry fail to see any practical aspect to the Reuther plan, involving the monthly consumption of 50,000,000 lbs. of aluminum alloy sheets—several times the amount that can be expected this year.

### Idle Machinery A Reality

The automotive industry has no quarrel with Mr. Reuther's statement that much idle capacity is available for manufacture of plane parts. But what the union official has not made clear is the fact that machine operations consume a relatively small part of the total productive hours spent in building a plane. Press work involves less than 2.0 per cent of total productive hours, machine work about 9 to 10 per cent. Much more important are the assembly operations, done for the most part with small tools. Sheet metal sub-assembly (fixing small parts into panels) consumes about 7 per cent of total productive hours, while riveting rises sharply to 20-25 per cent.

Building a pursuit ship involves about 18,000 man-hours of work, of which 10,000 is devoted to the airframe, 4,000 to the motor and 4,000 to accessories. At the rate of 500 ships daily, as advocated by Mr. Reuther, 1,000,000 men would have to be employed nine hours a day. The entire automobile industry currently employs about 443,000.

If 1,000,000 men were given employment building 500 pursuit planes daily, approximately 15,000 would be needed for press work and perhaps 100,000 for machine work. For the purposes of argument, grant that equipment could be found and tooled up within six months. (Mr. Reuther says that it can be done.) Where will space be found for over 800,000 assembly operators? The aviation industry currently uses about 100 sq. ft. of floorspace per man. If this ratio holds good in plane manufacture by auto plants, the floorspace needed for assembly operations alone under the Reuther plan would be nearly double the entire space planned for the aviation industry by the end of this year.

Production of aircraft parts poses many problems not met in automotive practice. Yet after study of the bomber parts displayed by the Auto Committee for Air Defense, responsible production officials express the view that most, if not all, of the parts can be made at some point or other in the automotive industry after adequate tooling-up.

It would seem that the National Defense Commission is well aware of the limitations upon expanding the raw materials output for plane production and more specifically what the automotive industry can do in respect to making plane parts. The bomber program looks for creation of manufacturing facilities in the auto industry for supplying about 50-60 per cent of the work involved in building that type of ship, the remainder to be handled by aviation manufacturers. Assembly plants are to be ready by the spring of 1942, to produce at the rate of 2400 two-engined bombers and 1200 four-motored bombers per year.

What does this mean to the automotive industry? The two-engined bomber requires about 50,000 man-hours of labor, the four-engined model possibly 110,000 man-hours. The total man-hours involved in building these ships runs to 250,000,000 man-hours per year. The amount of labor to be furnished by the automotive industry is highly speculative at this time, reports running anywhere from 50-75 per cent. Upon the basis of 50 per cent furnished by the automotive industry, 62,500 persons would eventually be given employment (each calculated as working 40 hours a week for 50 weeks).

If that is the picture, as seen by Mr. Knudsen, who is acknowledged to be perhaps the country's outstanding production genius, the Reuther plan, which seeks to accomplish many times this objective in one third the time, appears open to serious doubt.

# WATCHING WASHINGTON

## CIO Reuther's plan for speed-up of plane production seen as basis for complete reorganization of U. S. Defense. Office of Production Management functions as super U. S. Defense Board

By BLAINE STUBBLEFIELD

WASHINGTON—The 500-plane a day plan proposed by Walter Reuther of the CIO's United Auto Workers has captured the imagination of a public discouraged by the slow progress of aircraft expansion. Whether Detroit actually has the capacity to turn out any such number perhaps could only be settled by experiment, certainly will not be decided in Washington. It is obvious that regardless of the availability of machines and men there isn't the aluminum, manganese, guns and the instruments for any such output. But even fifty planes a day would quadruple present combat output. The administration won't be able to laugh off the plan without doing some explaining. So far, the President says, it's under study.

The Reuther plan has two main elements. On the one hand is the utilization of unused automotive capacity. A beginning, though so far a rather slow one, is being made towards this same objective in Knudsen's scheme for Detroit production of bomber parts. Reuther estimates that auto production utilizes not more than 50 per cent of actual capacity. This is considered a very low estimate by those familiar with the industry, but it must be remembered that Reuther's figure is based on the assumption that auto production could be spread out evenly over the year. A move in this direction might well be the most concrete immediate outcome of the plan.

But Reuther's proposal departs from the Knudsen scheme in that a much tighter organization is proposed. Reuther would set up a central committee, with equal representation for management, labor, and government, with full power to operate the plan. The committee would deal direct with the government and would parcel out parts production among the different auto builders according to their capacity. In essence, Reuther would treat the whole industry as if it were one big firm.

Under present procedure, on the contrary, the Auto Industry Defense Committee functions as a mere liason body, making studies and putting potential parts producers in touch with the plane builders, between whom subcontracts can then be worked out. Knudsen's scheme sticks to ordinary commercial procedures where Reuther would set up a little totalitarianism in Detroit.

The most significant aspect in the long run is that the plan is one example—and one with a high publicity value—of the basic reorganization of the defense set up for which the CIO wing of labor is pushing. The CIO plan, as presented to the President by Philip Murray, would set up in every defense industry just such an authoritative committee as Reuther proposes for aircraft. These "industry councils" would contain an equal number of labor and management representatives and a chairman representing the government. The councils would have full power to award contracts and to re-allocate contracts already awarded with the stated purpose of distributing the work more widely in the industries. The councils would also have control over labor relations in their industry. There would be a similarly organized "national defense board" to coordinate the work of the industry councils.

In addition to giving labor a far greater voice than at present in defense, the apparent effect of the CIO program would be to move farther from a contract-financial basis and nearer to a men-and-machines basis for the organization of defense.

There seems no reason to expect any early application of the CIO proposals. They are important because they provide a platform from which labor and the left wing of the New Deal can criticize the defense program. Moreover, they may come importantly to the fore if a continued lag behind schedule of defense production should result in a popular demand to take defense away from the businessmen. When the time comes that restrictions must be put on labor, acceptance of some such scheme might be the price of labor's consent.

### New Defense Board Functions

Appointment by the President of the "big four" office for production management in effect makes Knudsen head of national defense. It is believed that a tentative executive order setting up the OPM makes him "administrator-in-chief."

When Mr. Roosevelt announced his OPM board plan, it seemed to him politically unwise to name any one man the czar of defense production. But apparently he has had a change of mind, feeling that "unanimous decision" was too much to expect. Even under the unanimous decision plan, Mr. Hillman would have been in forced agreement with the other three, part of the time. If Knudsen becomes dictator, Hillman's position will be about the same thing: advisor. Secretaries of Army and Navy will also advise, and they will give the OPM its contract-signing power. Board decisions may be reviewed by the President.

The relation of the five-man defense commission to the OPM is not clear. Probably the commission will continue formally unchanged. Knudsen might continue to hold his production job in the commission, or he might appoint a successor.

### Patterson Named Under-Secretary

Creation of the new post of under-secretary of war theoretically changes the set-up of Army procurement, but it likely will not have any important effect. Under previous law, responsibility for conducting the business affairs of the War Department was specifically vested in the assistant secretary. The law just signed by the President vests all authority in the secretary and also creates the new post of under-secretary (higher than assistant secretary). Thus the secretary may now divide up the business side of the department between the under-secretary and the assistant secretary. Former Assistant Secretary Patterson has been made undersecretary, and no assistant has yet been appointed. Hence Patterson's duties have been unchanged. When an assistant secretary is named, chances are he will be assigned a lot of rather routine duties—like maintaining cemetaries—now handled by Patterson, while Patterson will retain procurement.

### WANT LABOR'S CONFIDENCE

WASHINGTON—There is a clue to the obscure problem of the administration's attitude towards labor and defense in two contradictory events of late last month. On the one hand, a $120,000,000 contract for Pratt & Whitney engines is given to Ford over the determined protest of labor's Defense Commissioner Hillman. At the same time Hillman is elevated to the co-chairmanship of the Office of Production Management. Taken together these facts seem to show a design to make no concessions to labor which will restrict production, but at the same time to gain labor's confidence—which is essential to the first objective—by giving it an increasing voice in administrative decisions.

## Contracts for Small Arms Plants Are Let by U. S.

WASHINGTON—Two contracts totalling $105,887,790 have been awarded by the U. S. War Department for the equipping and operating of a small arms ammunition plant at St. Louis, Mo. The Western Cartridge Co., East Alton, Ill. will receive $18,600,000 on a cost-plus-fixed-fee basis to supervise the layout, engineering and construction of the plant, procure the equipment, supervise its installation, and supply management services. The U. S. Cartridge Co., Baltimore, Md., will receive $87,279,790 for production of small arms ammunition. The Federal Government will retain title to the plant and the U. S. Cartridge Co. will also operate on a cost-plus-fixed-fee basis.

It is estimated that manufacturing operation will provide employment for 10,000 to 12,000 persons. The site of the new plant is in line with the general war department policy of encouraging the location of new national defense plants in the central part of the U. S.

Remington Arms Co., Bridgeport, Conn., will operate, on a cost-plus-fixed-fee basis, a government owned small arms ammunition plant which will be constructed in the vicinity of Denver, Colo. Negotiations are now in progress.

## British Create "Flying Squad" For Industry Maintenance

LONDON—The British Controller of Machine Tools has organized a "flying squad" for the engineering industry engaged on munitions. The emergency organization carries out lightning repairs of machine tools damaged by enemy action or broken down through overwork. The "flying squad" also organizes the supply of used machines drawn from a nation-wide reserve. Machines, which are not serving a vital national purpose, are liable for use in the production of munitions.

## Machine Shop Practice Told In "Twelve Easy Lessons"

MINNEAPOLIS—A series of 12 posters, "Twelve Easy Lessons in the Fundamentals of Machine Shop Practice" has been published by Continental Machines, Inc., Minneapolis, and outlines the basic principles of machine tools and metal working. The aim is to form a clear foundation for apprentices and the 12 posters have been arranged in a calendar form so that each lesson may be automatically displayed in a plant for one month. In that space of time, it is thought that the facts presented can be absorbed by all who take a little time to study it. The plan has been instigated because of a great shortage of skilled craftsmen.

## U. S. Government Contracts Awarded to Metal-Working Firms

*(Does not include contracts under $100,000)*

| Source | Agency | Commodity | Amount |
|---|---|---|---|
| The McKay Co., Pittsburgh, Pa | Navy | Chains and rings | $162,848 |
| DeLaval Steam Turbine Co., Trenton, N. J. | Navy | Pumps | 1,350,000 |
| Greenville Steel Car Co., Greenville, Pa | Navy | Railroad cars | 105,188 |
| Precise Tool and Manufacturing Co., Farmington, Mich | War | Gages | 123,687 |
| Travelcar Corp., Detroit, Mich | War | Semi-trailers | 121,360 |
| Eastman Kodak Co., Rochester, N. Y. | War | Fire control equipment | 3,710,016 |
| Standard Pressed Steel, Jenkintown, Pa | War | Ammunition components | 1,696,412 |
| Fairchild Aviation Corp., Jamaica, N. Y. | War | Fire control equipment | 516,474 |
| Freuhauf Trailer Co., Detroit, Mich | War | Trailers | 1,115,096 |
| Allison Engineering Co., Div. of General Motors Corp., Indianapolis, Ind | War | Airplane engines | 69,722,625 |
| Diamond T. Motor Car Co., Chicago, Ill | War | Trucks | 6,311,085 |
| Federal Motor Truck Co., Detroit, Mich | War | Tractor-trucks | 3,246,150 |
| Willys-Overland Motors, Inc., Toledo, Ohio | War | Trucks | 1,424,115 |
| Curtiss-Wright Corp., Curtiss Propeller Div., Clifton, N. J | War | Propeller assemblies | 63,202,820 |
| Clark Equipment Co., Battle Creek, Mich | War | Tractors | 552,502 |
| Link Aviation Devices, Inc., Binghamton, N. Y. | War | Link trainers | 4,097,412 |
| American Type Founders, Elizabeth, N. J | War | Artillery material | 570,380 |
| B. F. Goodrich Co., Akron, Ohio | War | Band tracks | 5,780,100 |
| Guiberson Diesel Engine Co., Chicago, Ill | War | Diesel engines | 3,891,705 |
| Firestone Tire & Rubber Co., Akron, Ohio | War | Small arms material | 3,986,340 |
| McEvoy Co., Houston, Texas | War | " " " | 810,360 |
| Universal Crusher Co., Cedar Rapids, Iowa | War | " " " | 802,410 |
| Variety Aircraft Corp., Dayton, Ohio | War | Stand assemblies | 115,200 |
| Standard Steel Works, N. Kansas City, Mo | War | " " | 178,850 |
| Pressed Steel Car Co., Inc., McKees Rocks, Pa. | War | Forgings | 1,230,000 |
| Pennsylvania Forge Corp., Philadelphia, Pa. | War | " | 164,785 |
| Revere Copper & Brass, Inc., Baltimore, Md | War | Cartridge cases | 125,199 |
| American Brass Co., Waterbury, Conn | War | Cartridge cups | 180,264 |
| Byron Jackson Co., Huntington Park, Calif. | War | Recoil mechanisms | 2,643,709 |
| Sebastian Lathe Co., Cincinnati, Ohio | War | Lathes | 177,641 |
| Unipress Co., Inc., Minneapolis, Minn | War | Pressers | 120,035 |
| LeRoi Co., Milwaukee, Wis | War | Air compressors | 976,500 |
| Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis | Navy | Boring machines | 103,104 |
| Gisholt Machine Co., Madison, Wis | Navy | Lathes | 107,397 |
| Willys-Overland Motors, Inc., Toledo, Ohio | War | Trucks | 1,438,500 |
| Ford Motor Co., Dearborn, Mich | War | " | 1,462,500 |
| American Bantam Car Co., Butler, Pa | War | " | 1,433,385 |
| Bendix Aviation Corp., South Bend, Ind | War | Wheel assemblies | 127,495 |
| Hayes Industries, Inc., Jackson, Mich | War | Wheel and brake assemblies | 613,629 |
| Hanson Clutch & Mach. Co., Tiffin, Ohio | War | Trailers | 234,847 |
| Bay City Shovels, Inc., Bay City, Mich | War | " | 218,190 |
| Rogers Brothers Corp., Albion, Pa | War | " | 118,426 |
| C. R. Jahn Co., Chicago, Ill | War | Tank cars | 134,500 |
| American Car & Foundry Co., Milton, Pa | War | " | 679,640 |
| American Car & Foundry Co., Wilmington, Del. | Navy | Lighters | 1,020,262 |
| American Car & Foundry Co., Berwick, Pa | War | Tanks | 697,155 |
| Minneapolis-Honeywell Regulator Co., Wabash, Ind | War | Gun sight assemblies | 244,500 |
| Sperry Gyroscope Co., Inc., Brooklyn, N. Y | War | Indicators | 9,961,240 |
| The Midvale Co., Philadelphia, Pa | Navy | Racks and pinions | 239,600 |
| Camden Forge Co., Camden, N. J | Navy | " " | 240,860 |
| Walter Kidde & Co., Inc., Bloomfield, N. J | War | Cylinder assemblies | 127,907 |
| Walworth Co., Greensburg, Pa | Navy | Valves | 126,057 |
| Edward G. Budd Mfg. Co., Philadelphia, Pa | War | Body assemblies | 847,443 |
| National Pneumatic Co., Inc., Rahway, N. J | War | Shell parts | 154,020 |
| Pratt Industries, Inc., Frankfort, N. Y | War | Tubes | 263,241 |
| National Forge & Ordnance Co., Irvine, Pa | War | Forgings | 139,633 |
| Pollak Mfg. Co., Arlington, N. J | War | Fuse parts | 955,350 |
| Scovill Mfg. Co., Waterbury, Conn | War | Booster parts | 720,000 |
| Stewart-Warner Corp., Chicago, Ill | War | " " | 742,930 |
| Thorrez & Maes Mfg. Co., Jackson, Mich | War | Liner assemblies | 161,250 |
| Hudson Motor Car Co., Detroit, Mich | War | Booster parts | 143,824 |
| Robertshaw Thermostat Co., Youngwood, Pa | War | " " | 352,100 |
| American Brass Co., Waterbury, Conn | War | Jacket cups | 209,720 |
| Miller Printing Machinery Co., Pittsburgh, Pa. | War | Gun mounts | 502,667 |
| Vickers Inc., Waterbury Tool Div., Waterbury, Conn | Navy | Pumps | 122,203 |
| Marvel-Schebler Carbureter Div., Borg-Warner Corp., Flint, Michigan | Navy | Controls | 226,237 |
| Koppers Co., Baltimore, Md | War | Gun carriages | 9,956,000 |
| Saginaw Stamping & Tool Co., Saginaw, Mich | War | Trailers | 289,599 |
| Ford Motor Co., Dearborn, Mich | War | Sedans | 685,200 |
| Bell Aircraft Corp., Buffalo, N. Y | War | Adapters | 229,245 |
| Service Tool & Engineering Co., Dayton, Ohio | War | Sight assemblies | 154,000 |
| White Motor Co., Cleveland, Ohio | War | Scout cars | 6,984,151 |
| American Car & Foundry Co., New York, N. Y. | War | Tanks | 37,642,658 |
| American Car & Foundry Co., Berwick, Pa | War | " | 10,351,745 |
| Duplex Printing Press Co., Battle Creek, Mich. | War | Gun carriages | 6,088,440 |
| Western-Austin Co., Aurora, Ill | War | Caissons | 240,280 |
| Pullman Standard Car Mfg. Co., Chicago, Ill | War | Carriages | 5,775,575 |
| York Safe & Lock Co., York, Pa | War | " | 1,006,720 |
| Watson Automotive Equipment Co., Washington, D. C | War | Semi-trailers | 974,460 |
| Sperry Gyroscope Co., Inc., Brooklyn, N. Y | Navy | Pilots | 3,044,887 |
| Weston Electrical Instrument Co., Newark, N. J. | War | Ammeter and voltmeter assemblies | 110,728 |
| Barnard Aviation Equipment Co., Inc., Ashley, Pa. | War | Hoists | 429,400 |
| Minneapolis-Honeywell Regulator Co., Minneapolis, Minn | War | Sight assemblies | 244,500 |
| Fruehauf Trailer Co., Detroit, Mich | War | Trailers | 556,950 |
| Bendix Aviation Corp., Pioneer Instrument Div., Bendix, N. J | War | Meters | 1,942,560 |
| Revere Copper & Brass, Inc., Rome, N. Y | War | Small arms ammunition | 141,393 |
| Hershey Metal Products Inc., Derby, Conn | War | " " " | 106,675 |
| The Buda Co., Washington, D. C | Navy | Diesel engines | 1,304,988 |
| Yellow Truck & Coach Mfg. Co., Pontiac, Mich. | War | Trucks | 31,718,137 |
| Corbitt Co., Henderson, N. C | War | " | 1,460,000 |
| Mack International, Long Island City, N. Y. | War | " | 759,200 |
| E. I. duPont de Nemours & Co., Repauno Works, Gibbstown, N. J | War | Artillery ammunition components | 330,000 |
| Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J | War | Maintenance parts | 294,474 |

## Increase Seen in Machine Tool Motor Production for 1941

WASHINGTON—U. S. electrical manufacturers will be able to ship 40 per cent more machine tool motors in 1941, provided that the machine tool industry, electric motor manufacturers, and the government continue to cooperate. As it takes from two to three times as long to build a machine tool as it does the motors that are used to drive them, proper cooperation must be received to facilitate coordinated defense production.

Maximum speed may be obtained when machine tool builders give orders for motors to electrical manufacturers just as quickly as they receive their machine tool orders. If at that time the machine tool builder specifies the date of shipment that is required for the motors to meet the machine tool shipping schedule, the motor manufacturer can work out a production schedule which will be advantageous to all parties.

In order to reduce engineering and drafting time to a minimum, machine tool builders may use existing designs of machine tool motors as far as possible. In those cases where special designs are required, approval of the electrical manufacturer's drawings ought to be given within ten days to speed production.

## U. S. Authorizes Expansion For the Manufacture of Gages

WASHINGTON—The U. S. War Department has authorized the immediate plant expansion of facilities for the production of gages by the following concerns:

| *Firm* | *Amount* |
|---|---|
| Sheffield Gage Corp., Dayton, Ohio | $910,000 |
| Pratt & Whitney Div., Hartford, Conn. | 1,140,000 |
| Taft-Peirce Mfg. Co., Woonsocket, R. I. | 400,000 |
| The Greenfield Tap & Die Corp., Greenfield, Mass. | 1,009,000 |

Under the terms of the contracts which these concerns have, they will finance the expansion themselves to be repaid by the government over a period of five years. During this period they will rent the added facilities from the government, which in this way will recover approximately 20 per cent of the original cost of the expansion in the form of rent. The rent charge is necessary because there is no operations contract awarded with the one for plant expansion. At the end of five years the contractor will have the option to purchase the property at cost, less some prearranged rate of depreciation or, alternatively, at some negotiated sum.

*Heads Austin Co.*

GEORGE A. BRYANT

*Gets Directorship*

CHARLES J. STILWELL

*Directs Materials*

HARRY A. STRAIN

## NAMES in the NEWS

Alexander S. Anderson has been named district manager for the midwestern territory of the Duff-Norton Mfg. Co., Chicago.

George A. Bryant has been elected president and general manager of the Austin Co., national engineering and construction company. Mr. Bryant, who succeeds the late W. J. Austin, had been executive vice-president and general manager since 1930.

Frank W. Caldwell, director of research, United Aircraft Corp., has been elected president of the Institute of the Aeronautical Sciences. A specialist in aircraft propellers since 1916, Mr. Caldwell received the institute's award in 1935.

George E. Cullinan, senior vice-president, Graybar Electric Co. Inc., New York, has retired after 39 years of service with the company.

Charles B. Jahnke has been elected president, general manager and member of the executive committee, Cooper-Bessemer Corp., Mt. Vernon, Ohio. Mr. Jahnke has been chief engineer of the corporation since 1935. Formerly he had served as works manager and director of engineering, Fairbanks-Morse Co., Beloit, Wis., and as diesel engineer with International Harvester Co., Chicago.

Leonard S. Parker, formerly superintendent of production, Skilsaw, Inc., Chicago, has been named vice-president in charge of operations.

Harold M. Malm, a former metallurgist, has been appointed factory sales engineer, Callite Tungsten Corp., Union City, N. Y.

Elmer Ghrist has been appointed metallurgist for the Jessop Steel Co., Washington, Pa.

Robert L. Lerch has been appointed general manager of Haynes Stellite Co., unit of Union Carbide and Carbon Corp. Mr. Lerch has been associated with the organization since 1924.

Charles J. Stilwell, president, Warner & Swasey Co., has been elected a director of the Cleveland Trust Co.

Clinton D. St. Clair has been appointed works manager of the Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn. At various times Mr. St. Clair has been associated with B. F. Goodrich Co., Erie City Iron Works, and American Machine and Metals, Inc.

Harry A. Strain, formerly assistant general superintendent at South Chicago Works, Carnegie-Illinois Steel Corp., has been appointed director of raw materials, fuel and power. Mr. Strain began his association with the parent corporation, U. S. Steel, in 1905. M. J. Devaney succeeds Mr. Strain. E. G. Hill has been named assistant general superintendent, Gary Works.

Addison S. Vars has been elected president of the Sterling Engine Co., Buffalo, and Edward H. Townsend was named executive vice-president and treasurer. Spencer H. Logan, president of the company since 1939, was elected chairman of the board, succeeding Charles A. Criqui, who was named vice-chairman. Frank G. Raichle and Mr. Townsend were both elected to the Board of Directors.

F. E. Whittlesey, general manager, Raymond Mfg. Co., Corry, Pa., has retired after 50 years of service with the company.

## PLANT EXPANSION

Allegheny Ludlum Steel Corp., Brackenridge, Pa., will expand its production facilities at a cost of $2,000,000. The company's alloy steel capacity will be increased by 50,000 tons a year.

Beech Aircraft Corp. has negotiated with RFC for a loan of $13,540,508, the proceeds of which will be used to provide additional plant facilities, equipment and working capital. New buildings which will increase production floor area from 220,000 sq.ft. to 468,850 sq.ft. are already under construction. Other additions will bring the total area of the Beech factory to around 550,000 sq.ft. The company has a total backlog of over $22,000,000, almost 10 times the company's deliveries for fiscal 1940.

Carnegie Illinois Steel Corp. has negotiated a contract with the government in which $45,000,000 will be spent for building, machine tools and equipment for a government leased plant at South Charleston, W. Va. The company will manufacture ordnance material.

R. G. Haskins Co., manufacturers of tapping machines and shaft equipment, are building an addition to their factory in Chicago. The new unit will provide approximately 8,000 sq.ft. of manufacturing space.

SKF Industries, Inc., Philadelphia, manufacturers of ball and roller bearings, is erecting an addition of 56,200 sq.ft. of manufacturing floor space. The total inclosed area of its plant amounts to 666,600 sq.ft.

RCA Mfg. Co., Camden, N. J., will spend $2,370,034 to expand its manufacturing facilities at Camden, N. J., and Indianapolis, Ind. The expansion will proceed under a contract award received from the U. S. Navy.

Crucible Steel Co. of America will spend about $10,000,000 in expansion in the next two years. Most improvements will be made at its plant in Midland, Pa. where a new strip mill, electric furnaces and auxiliary equipment will be installed.

Chicago Rivet & Machine Co., Chicago, has let contracts for a new plant which will more than double its present floor space. The new plant will be located in Bellwood, a Chicago suburb.

Gardner-Denver Co., Quincy, Ill., has purchased a 13 acre plant. In addition, a new plant unit of 40,000 sq.ft. will be constructed soon.

Electro-Motive Corp., La Grange, Ill., has begun plans for an additional 90,000 sq.ft. to be added to its plant. The new unit, 250 x 360 ft., which will cost about $300,000, will be completely air conditioned and will be used for general manufacturing of diesel engines.

Independent Pneumatic Tool Co. is building a new plant in Los Angeles which will cost $500,000.

Lempco Products, Inc., Bedford, Ohio, manufacturers of automotive service equipment and machinery, will expand their plant and production facilities almost 50 per cent.

The Ingalls-Shepard Div., Wyman-Gordon Co., steel forgings, has started work on an addition to its Harvey plant which is expected to increase employment from 1,000 up to 1,500 men on completion of the unit in July. Plant expansion is expected to cost about $150,000 with equipment costing more than a million dollars.

Fansteel Metallurgical Corp., North Chicago, is planning an expansion project to cost about $150,000. A new building of about 62,500 sq.ft. and new equipment is included.

**A. B. Morey**—*His election as vice president, Gisholt Machine Co., was announced in these columns (AM, Dec. 25, 1940, p1096k)*

## BUSINESS ITEMS

Curtiss-Wright Corp. has acquired the Marmon Co. plant at Indianapolis, Ind. Machinery is being installed for the production of electric propellers for airplanes. The plant will employ more than 4,000 skilled workmen.

The Penn General Supply Co., Pittsburgh, Pa., is now handling the products of Geometric Tool Co., New Haven, Conn.

Crobalt, Inc., Ann Arbor, Mich., manufacturers of a non-ferrous cutting alloy for machine cutting tools, has moved to its new plant at Ann Arbor.

## OBITUARIES

Stephen Birch, founder and chairman of the board of directors, Kennecott Copper Corp., New York, N. Y., died last week. Mr. Birch was also president, Alaska Steamship Co.; chairman of the board, Braden Copper Co.; a director of the Alaska Development and Mineral Co.

Carlisle S. Greene, 41, vice-president in charge of purchasing, Greene Mfg. Co., Racine, Wis., died on Dec. 23 of a heart attack.

Arthur C. Houser, 52, manager of the Cleveland Diesel Engine division, General Motors Corp., Washington, D. C., died recently.

John C. Luland, 87, expert in the heat treatment of steel, died recently in New York. Mr. Luland retired a year ago from his position with Crucible Steel Co. after 67 years of service. He is said to be the first man to develop a steel that would penetrate "Krupp" armor plate. He was a close student of steel processes and became a specialist on alloy tool steel.

Gustav E. Strandt, 65, president of the G. E. Engineering Co., Milwaukee, and inventor of the rotary milk bottle filler and capper, died recently after a year's illness.

C. Harold Wills, former chief engineer of the Ford Motor Co. and later president of the Wills-St. Clair Motor Car Co., died last week at the age of 62. Mr. Wills designed the Model T Ford, and every other model the Ford Company produced from June 1903, until his resignation from the company in March 1919. During the World War he was prominent in the production of Liberty motors for airplanes.

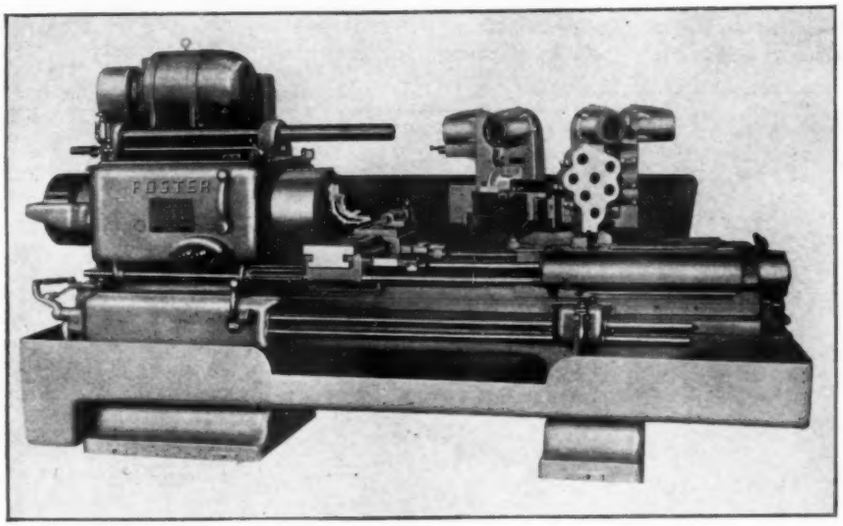
When Mr. Wills quit the Ford Co. in 1919, he had become a millionaire, and shortly afterward founded his own auto manufacturing company. His Wills-St. Clair car was on the market only until 1927, however, and he devoted himself to metallurgical research thereafter. He became one of the nation's leading commercial metallurgists and mechanical chemists. In the automobile industry he was known for his development of vanadium steel and the invention and development of molybdenum steel. His most recent invention in the field was amola, a steel alloy, upon which he was working until his death.

## MEETINGS

Machine and Tool Progress Exhibition. Sponsored by the American Society of Tool Engineers. Convention Hall, Detroit, Mich., March 25-29.

# SHOP EQUIPMENT NEWS

## Automatic Spindle Speed Changes Featured In New Foster "Fastermatic" Turret Lathe



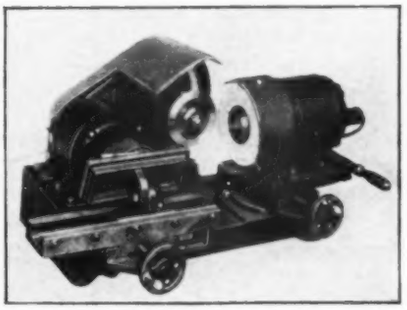

Similar in design to the No. 2-F machine which was announced recently, the No. 1-F "Fastermatic" turret lathe developed by Foster Machine Co., Elkhart, Ind., features automatic spindle speed changes which are selected by means of a spool on the machine front. Changes are made through hydraulically operated multiple-disk clutches controlled by buttons readily applied and adjusted on this spool. With this device changes may be made at any time during a cut or at the end of a stroke. Changes may be used with as many turret faces as required. The number of changes to a single turret face is controlled by the number of buttons on the spool, the longitudinal position of the buttons determining when the changes will be affected. When no automatic changes are required, the buttons are simply removed from the spool.

The machine has a regular range of 27 spindle speeds from 22 to 332 r.p.m. These are arranged in nine sets of three automatic changes. Any group of these automatic changes may be obtained by a set of pick-off gears. Since there is always a positive flow of power to the spindle during the speed changes, the spindle does not stop or hesitate between changes, insuring a smooth, uniform finish and eliminating possibility of tool breakage. Helical gear train, shafts, spindle and entire transmission mechanism run in a bath of oil. The spindle is equipped with a quick acting brake. The machine head is a semi-steel casting with nitrided V ways of more than 1,000 Brinell hardness. Readily selected hydraulic feeds provide a separate feed for each turret station and assure longer tool life.

The hexagon turret may be indexing or non-indexing. Front and rear cross slides are independent of each other. Either or both of the slides may be used in conjunction with as many turret stations as desired. Machines may be hand operated for setting up. Specifications: Swing over bed, 21 in.; total distance, spindle nose to turret face, 41 $\frac{11}{16}$ in.; weight, approximately 7,000 lb; floor space, 40$\frac{5}{8}$ x 122 in.

## Midget Slitter Grinder Sharpens Small Knives

Samuel C. Rogers & Co., 191–205 Dutton Ave., Buffalo, N. Y., has developed the Type CC midget slitter grinder for circular slitters up to 6 in. in diameter and straight corner cutters up to 8 in. long. When this device is also provided with a drill grinder attachment, it has a capacity for drills up to $\frac{1}{2}$ in. in diameter. A specially designed chuck and V-block center the drill, insuring proper angle between point and lip as well as proper lip clearance.



The device occupies a bench space approximately 2 ft. square. It weighs about 85 lb.

## Kidder "Little Blacksmith" Cuts Squares, Circles

Squares, circles, notches and irregular shapes can be cut in $\frac{1}{8}$-in. mild steel with the No. 42 "Little Blacksmith" hand punch built by J. F. Kidder Mfg. Co., 426 Colchester Ave., Burlington, Vt.

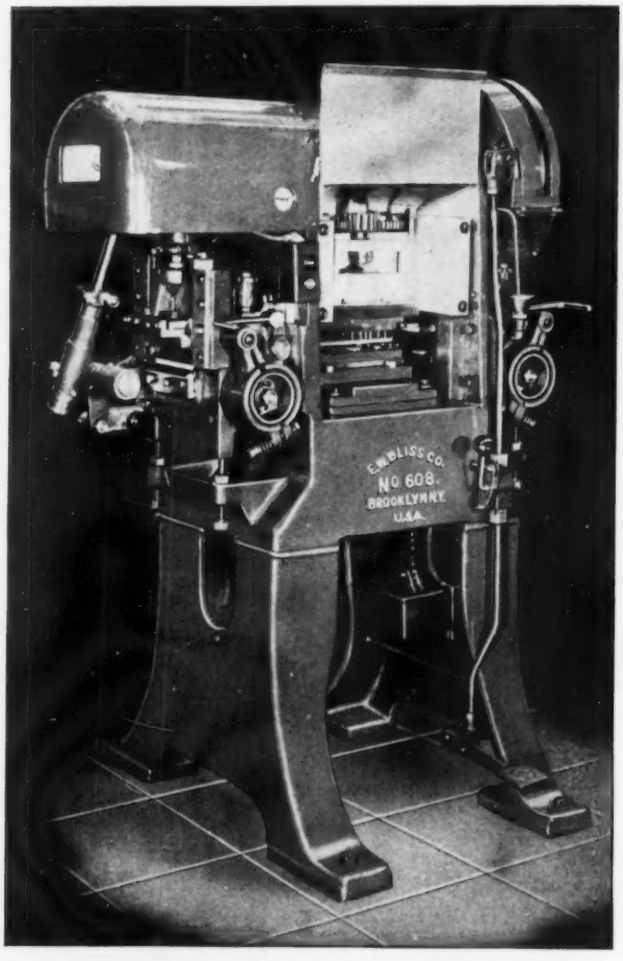
Of steel plate arc welded construction, this device has a throat depth of 7 in. and can be equipped with attachments for sheet punching, angle iron shearing and miscellaneous shape notching. Weight of the machine is approximately 300 lb.

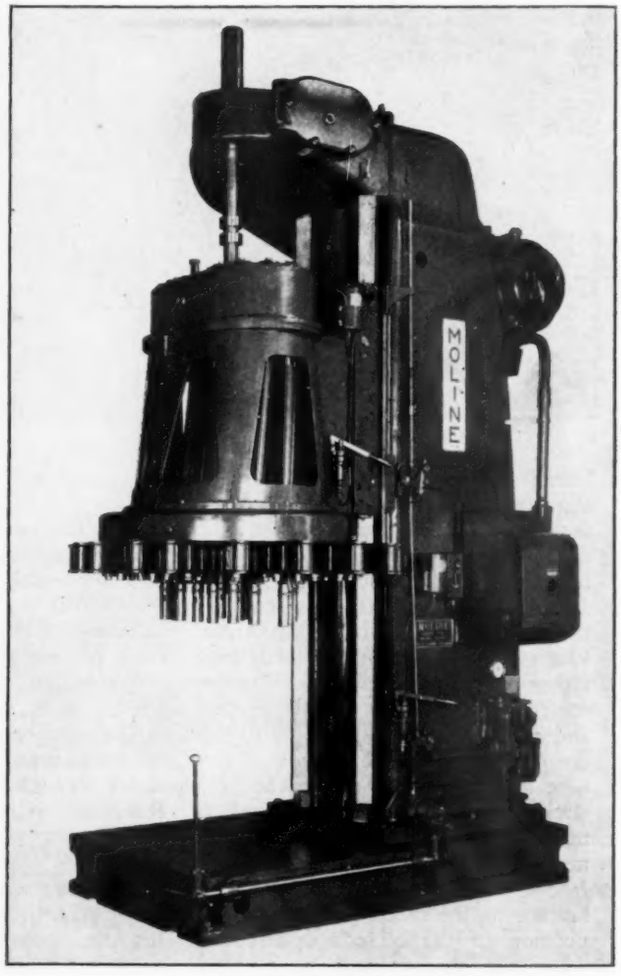
## Moline Multiple-Spindle Drilling Machine Has Greater Capacity Than Previous Models

The No. 116-U multiple-spindle drilling machine built by Moline Tool Co., Moline, Ill., while similar to previous drillers built along the same line, is larger and heavier and has considerably greater drilling capacity. A universal joint driven, hydraulic feed machine, it employs a floating splined shaft to transmit power from the upper drive head to the spindle drive head gear box where the 16 spindle drivers are located. Each spindle driver is independently adjustable for either of two rotational speeds or neutral.

The upper drive head contains the pick-off or speed change gears as well as the driving spiral which is in engagement with the spiral gear on the upper end of the splined shaft. All gears and bearings, both in the spindle drive head gear box and in the upper drive head, are lubricated by an automatic circulating oiling system.

Two motors are used on this machine, one to drive the spindles, and the other to drive the hydraulic feed unit. Mechanical feed control provides an automatic operating cycle consisting of rapid approach, feed, rapid return and stop. Specifications: Vertical spindle adjustment, 2¼ in.; working stroke of hydraulic feed cylinder, 36 in.; drilling area, 30-in. diameter circle; floor area required, 9 x 5 ft.; over-all height, about 15 ft.




## Bliss High-Production 8-Ton Press Operates at 1200 Strokes per Minute

Speeds up to 1,200 strokes per minute are possible with the No. 608 high-production press developed by E. W. Bliss Co., 53rd St. and 2nd Ave., Brooklyn, N. Y. This 8-ton press employs a heavy one-piece frame cast from high-test pearlitic iron, and a light cast-steel slide.

Two steel connections and bronze lined gibbing of generous length help maintain excellent alignment of the slide, thus assuring long die life. Electric detectors can be employed in connection with an electric protective trip. Specifications: Distance from bed to slide with adjustment up, 7 in.; standard stroke, ¼ in.; face of slide, 7 x 10 in.

## Victor Hacksaw Blade Said to be Unbreakable

A tungsten alloy hacksaw blade with cutting qualities of all-hard tungsten blades, yet claimed to be so flexible that it cannot be broken in a frame, has been developed by Victor Saw Works, Inc., Middletown, N. Y. This blade, known as the Victor Unbreakable Special Flexible, is said to obtain its combination of opposing qualities through the use of a new tungsten alloy, heat-

treated by a recently developed process. The blade bears an over-all patented black metallic protective finish, which provides lubrication and identification.

## Adjustable Speed Drive Made in Larger Sizes

To meet the demand for its all-electric, a.c. adjustable-speed drive in sizes which would extend this method of control to larger applications, particularly in printing, textile and machine tool fields, Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland, Ohio, has introduced additional "V-S" units of 20, 25 and 30 hp. These units are mounted horizontally instead of vertically as in the smaller sizes. Brackets contain special longitudinal rubber shock pads to insure quiet operation. No special foundation or levelling is required.

Three wires from the 3-phase, 60-cycle power, 220, 440, or 550 volts, are connected to the control unit exactly as would be done with any motor and control. From the control unit, secondary circuits are run to the other three elements of the drive, namely, the driving motor, speed adjuster, and pushbutton station. Both the speed adjuster, which is no larger than an ordinary plate rheostat, and the buttons for starting and stopping the motor, can be located anywhere on the machine.

The motor can be started and stopped without interfering with the speed setting. Speed can be changed while the motor is in operation. Quick stopping is obtained by regenerative braking. No clutches are needed. Drives not only make available very slow speeds for such operations as setting up work, but provide an almost infinite number of speeds within the 16:1 range for continuous 24-hr. duty. An even greater range is possible where service is intermittent.

## Jansson Gage Set Contains 81 Blocks

Jansson Gage Co., Farmington, Mich., has developed a set of 81 gage blocks with which combinations may be built up from 0.200 to 12.000 in. in steps of 0.0001 in.

These blocks are made of alloy steel to insure long life. A special heat-treatment is said to eliminate dimensional changes. Blocks are made in three grades of accuracy—0.000008 in. per in., 0.000004 in. per in., and 0.000002 in. per in. Chrome plated blocks are also available.

## "Cleco" Sheet Holder Speeds Aircraft Assembly

Time, effort and energy are saved in assembling aircraft and other sheet metal structures with the use of "Cleco" sheet holders and specially designed forceps made by Cleveland Pneumatic Tool Co., 3734 E. 78th St., Cleveland, Ohio. The holder itself consists simply of a small steel cylinder with spring-actuated locking plunger, which can easily be inserted and removed from

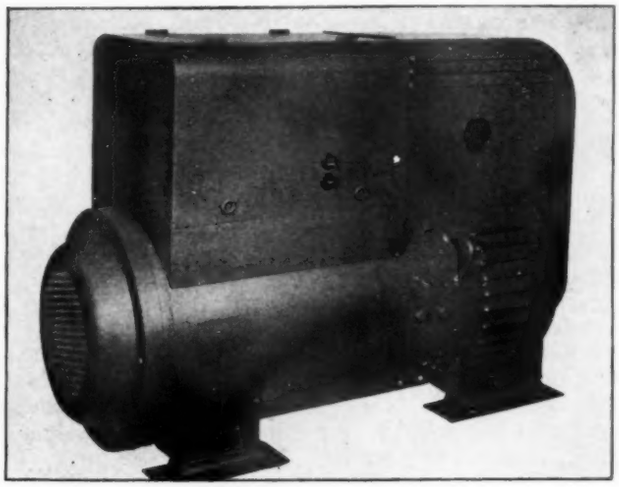
one side of the sheet. It is claimed that 80 per cent of the time required for securing metal sheets prior to riveting can be saved.

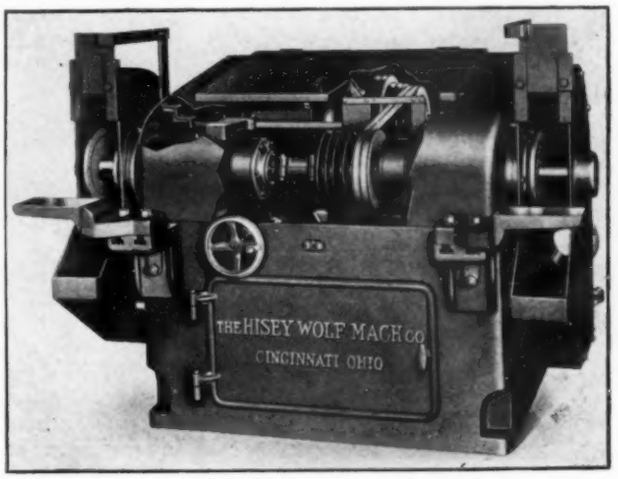
Holders are available in sizes of $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{3}{16}$ in. No redrilling or reaming is necessary. Vibration of riveting fails to loosen them. Gaskets prevent scratching the metal surface. Different sizes are finished in different colors.

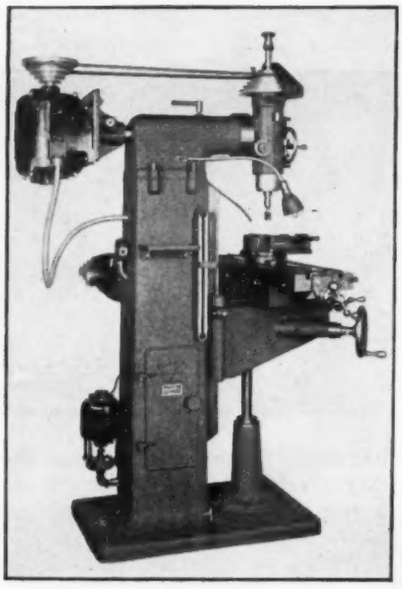
## Hisey Snagging Grinders Operate at High Speed

Hisey-Wolf Machine Co., Cincinnati, Ohio, has developed a line of snagging grinders for high-speed or vitrified grinding wheels, which are built in 18-, 20-, 24- and 30-in. wheel sizes. Wheel guards are those adopted by the American Foundrymens' Association. With these guards it is said to be impossible for a piece of work to jam between the wheel and guard.

Standard stock open rated motors can be used, mounted on a dovetail slide base with screw adjustment. The screw extends through front of pedestal and has a quick-acting handwheel which is used to transfer the belts from one set of sheaves to the next. Machines can be furnished with 1, 2, 3 or 4 speeds. A special device prevents overspeeding.







## Improved "Millmaster" Employs Two Speed Motor

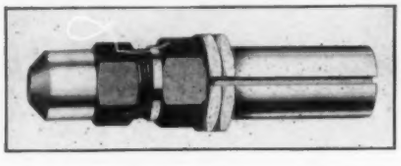
Midway Machine Co., 2324 University Ave., St. Paul, Minn., has added to its "Millmaster" line of milling machines a model equipped with a two-speed motor and special controller. It has been designed for special application where very rapid speed changes are necessary.

This model employs a constant-torque 575–1,140 r.p.m. 1-hp. three-phase ball bearing motor with a drum type controller which obtains instantly either high or low speed. With this drive the speed range of the machine is from 130 to 4,400 r.p.m. with 14 separate spindle speeds.

## Erickson Precision Eccentric Eliminates Use of Bushings

No bushings are needed with the precision eccentrics developed by Drill Chuck Div., Erickson Steel Co., E. 80th & Bessemer Ave., Cleveland, Ohio. These eccentrics adapt precision collet chucks for use on automatic screw machines at considerable savings in time and expense.

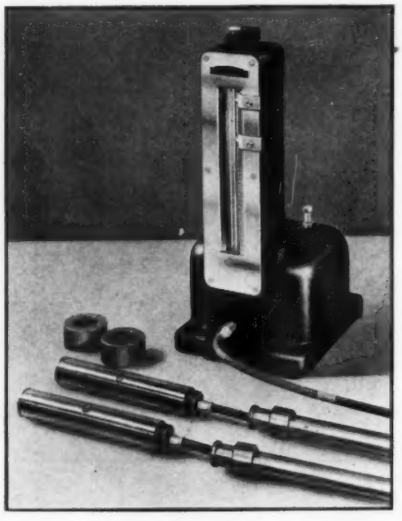
Faster speeds and more accurate holes are said to be made possible, since twist drills, reamers and other tools may be set to any desired length by means of an adjustable thrust screw. Eccentric principle makes centering very simple as the hexagons themselves act as measures. Each point on the hex has an eccentricity of 0.005 in.



## "Precisionaire" Gage Checks Long Bores

Sheffield Gage Corp., Dayton, Ohio, has developed the "Precisionaire" flow type air gage for checking gun bores to eliminate the necessity for high operative skill, maintain maximum precision standards and materially increase inspection speed. This instrument operates on the principle based on velocity or volume of air at constant pressure flowing during the gaging operation, instead of on the principle of varying air pressures during gaging.

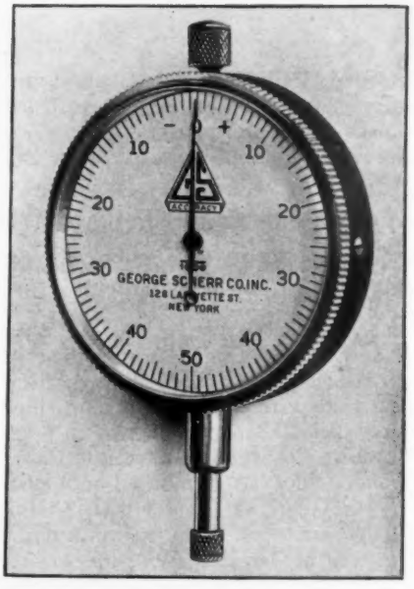
This gage checks the diameter of bores of any length and caliber. It can also check the diameter of the rifling



grooves in the gun barrel. It indicates not only the interior diameter to any degree of precision but also the location and amount of out-of-round, taper or bell-mouth. It indicates the condition of every increment of length throughout the bore, without the necessity of taking a series of separate readings. It may be used to check internal diameters of parts still mounted on the boring machine. In some cases it may also be used to check alignment of holes.

In cases where the inner circumference of a bore is more critical than its actual diameter, such as a thin walled, easily distorted bushing, which will eventually be pressed into a rigid casting or other assembly, the gage is said to furnish a more accurate check than any other gage because it can measure the average diameter of the bushing from end to end instead of the actual diameter at any given point. Use of this air gage imposes no distorting pressure on the piece being gaged.

The device utilizes no contacting fingers or hard gaging points. Consequently it is useful in inspecting such parts as artillery recoil cylinders, the interior finish of which is important.




## Dial Test Indicator Offered by George Scherr

George Scherr Co., 128 Lafayette St., New York, N. Y., has designed its "GS" dial indicator with a simplified lever movement. Instead of the usual rotating multiple gear and pinion trains, this indicator utilizes a lever arm, and is constructed on the principle that the simpler the mechanism the greater will be the accuracy and durability of the tool.

Dial is graduated in 0.001 in. with a plunger travel of $\frac{3}{16}$ in. Indicator can be supplied with universal ball joint back which permits a wide range of settings on all types of machines. Movement is mounted between separate top and bottom plates, and the hair spring is mounted between two flat plates and cannot interfere with the lever rack. Plunger is hardened and ground and has nickel-silver bearing.

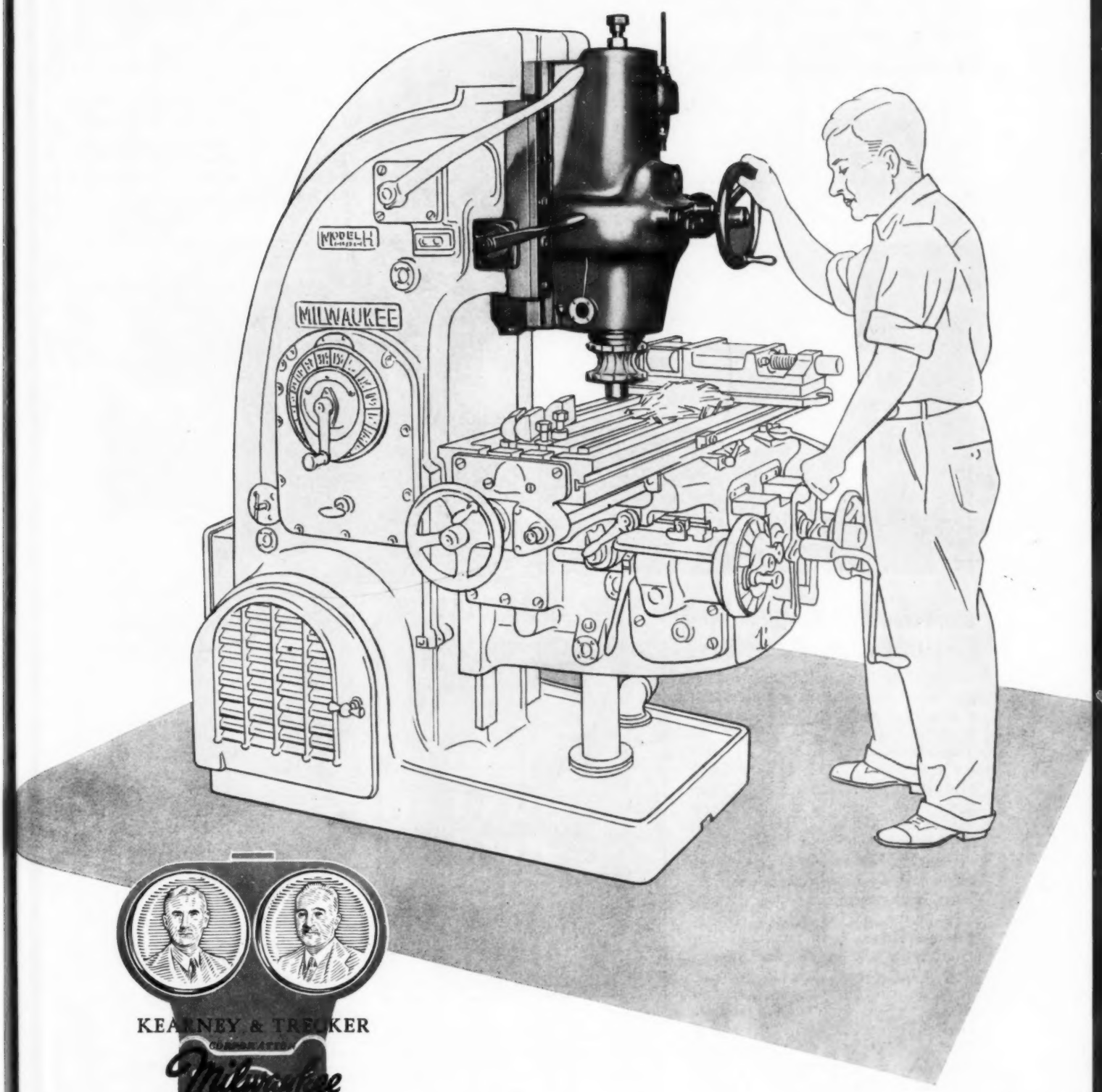
## "No-Buff" Concrete Dye Minimizes Floor Dust

"Flor-Dye No-Buff" concrete floor dressing, developed by Truscon Laboratories, Box 69, Milwaukee Junction P. O., Detroit, Mich., is claimed to permanently color and dustproof concrete floors without the necessity of polishing. Material penetrates from $\frac{1}{16}$ to $\frac{1}{4}$ in., and becomes an integral part of the surface. Thus many years of hard wear are required to scuff off appreciable dyed concrete.

Following dying of the cement, a dressing or finish is applied with a paint brush which sets the dye. This makes the color uniform and produces a richer and deeper hue. The material contains no wax, and therefore is not slippery.

The spindles of Milwaukee Vertical Milling Machines have the same powerful drive as those of the horizontal models . . . with the spindle gears mounted solidly on the spindle. Thus power is delivered to the spindle through low torque, high speed shafts.

KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.



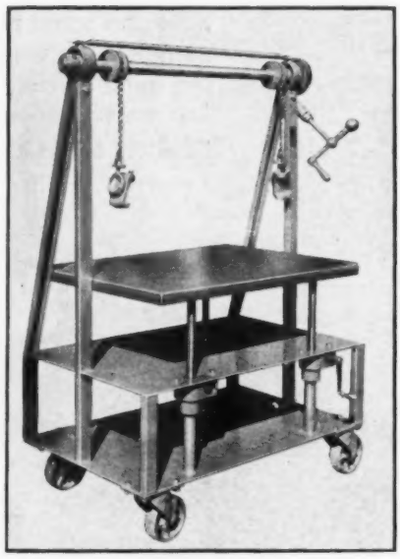

KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

# MILWAUKEE MILLING MACHINES

## Fire-Fighting Trailer Employs Carbon Dioxide

Six 50-lb. carbon dioxide cylinders are carried on a fire-fighting trailer developed by Walter Kidde & Co., Bloomfield, N. J. Cylinders are manifolded together and are operated by valves on each cylinder. Carbon dioxide gas is discharged onto the fire through 100 ft. of ½-in. hose. Control of the discharge is effected directly at the nozzle.

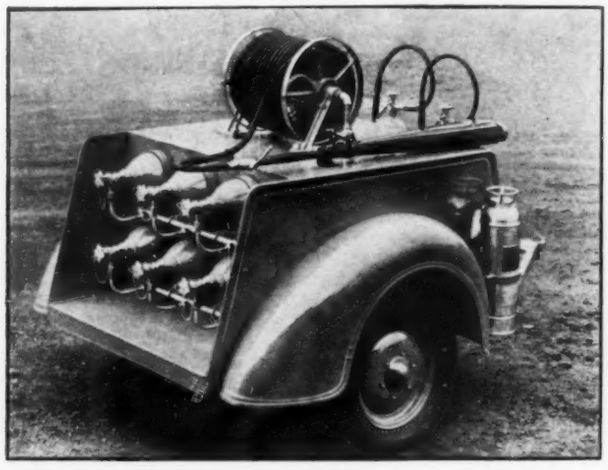
For smaller fires, two portable carbon dioxide extinguishers of 15-lb. capacity are carried on the front platform of the trailer. Two 2½-gal. water extinguishers are also included in the equipment. The trailer unit is designed especially for use on large fires of inflammable liquid and electrical equipment.

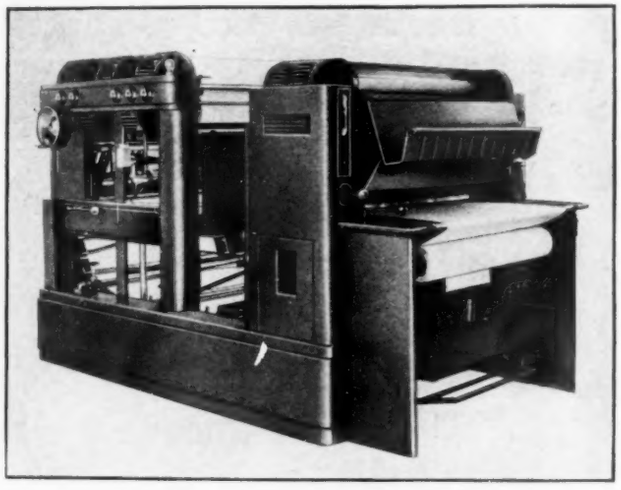


## "Multiduty" Die Truck Features Rugged Construction

The improved "Multiduty" die truck built by O. Johnson Mfg. Co., Brookfield, Ill., has been made available in two sizes—the No. B-1 which will handle dies up to 40 in. long, and the No. B-2 for dies up to 32 in. long. The former model has an over-all length of 44 in., width of 28 in., height of 66 in., and a 28x40-in. table. Table height is 24 in. minimum and 40 in. maximum. Safe load is 3,000 lb. This model weigh 450 lb.

The No. B-2 has an over-all length of 36 in., width of 24 in., height of 66 in., and a table measuring 24 x 32 in. Table has a minimum height of 24 in. and maximum height of 40 in. Safe load is 2,000 lb. Unit weighs 375 lb.





## Gas-Fired Unit Heaters Offered by Reznor Mfg.

A line of gas-fired unit heaters for use in factories, storerooms and similar places has been introduced by Reznor Mfg. Co., 108 James St., Mercer, Pa. These heaters need no water or steam for operation, and are said to throw heat evenly over large areas. Three types, each available in five sizes to provide from 55,000 to 200,000 B.t.u. per hr., are included.

Fan-type heaters are equipped with four-blade, electrically driven propeller fans. Heat exchangers reduce air noise to a minimum. Products of combustion are carried from the combustion chamber into the flue chamber and thus they never come in contact with air being heated. Blower type heaters are efficient where installations must be made in connection with a duct system. Duct-type heaters are designed especially for use in systems where air is supplied by a remotely situated blower of proper capacity for the total number of duct unit heaters employed.

All heaters can be furnished to burn natural, manufactured or liquefied petroleum gas, and are completely equipped with automatic controls, which have been especially developed for safe and efficient operation.

## Pease Blueprint Machine Provides Lower Speeds

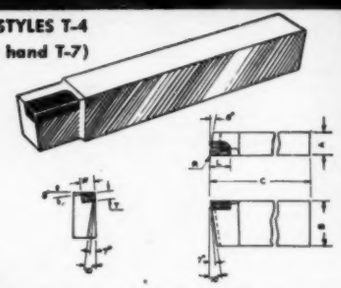
Two types of blueprinting units are combined in the Model 22-16 blueprinting machine offered by C. F. Pease Co., 2601 W. Irving Park Rd., Chicago, Ill. Consisting of a Model 22 printer operating with a Model 16 washing and drying machine, this unit has been designed for use when drafting departments do not require the high speed of the Model 22, but desire the Model 22's exclusive features.

Although the 24 ft. per min. actual printing speed of the Model 22 printer exceeds the 15 ft. per min. washing and drying speed of the Model 16 washer and dryer, only large prints can be fed at extreme speeds. With the Model 22 printer slow blueprint paper can be used, thus yielding better prints.

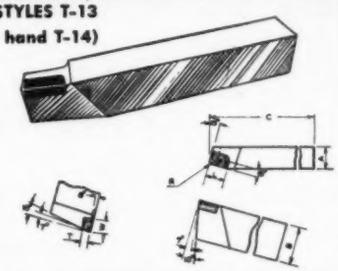
Outstanding features of the model include sliding contact which smoothes out the tracings, three-speed lamp control, a horizontal water wash which floats exposed paper horizontally, and a quick-change chemical applicator.

# FOR FASTER DELIVERY and MAXIMUM ECONOMY Specify THESE STANDARD CARBOLOY TOOLS!

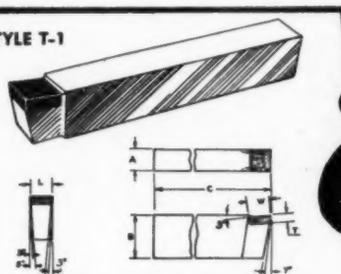
STYLES T-4
(left hand T-7)

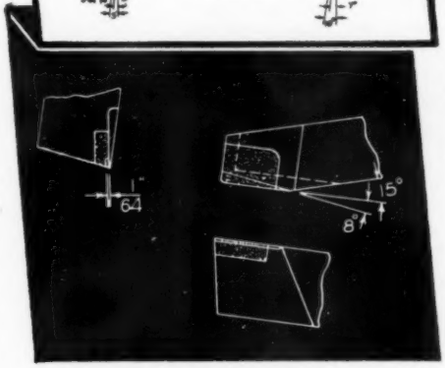


STYLES T-13
(left hand T-14)



STYLE T-1






**ALL STANDARD TOOLS ARE GROUND READY FOR USE**

**Steel Cutting Tools Styles 4, 7, 13, 14 have ground-in chip breaker as illustrated above.**

**SPECIFICATIONS—CARBOLOY STANDARD TOOLS**

| TOOL ORDER NUMBER | | | | | Shank Size | | |
|---|---|---|---|---|---|---|---|
| Right Hand Style T-4 | Left Hand Style T-7 | Right Hand Style T-13 | Left Hand Style T-14 | Style T-1 | A | B | C |
| T-42<br>T-43 | T-72<br>T-73 | | | T-12<br>T-13 | 5/16<br>3/8 | 5/16<br>3/8 | 2¼<br>2½ |
| T-45<br>T-47 | T-75<br>T-77 | T-137 | T-147 | T-15<br>T-17 | ½<br>5/8 | ½<br>5/8 | 3½<br>4 |
| T-48<br>T-406 | T-78<br>T-706 | T-148<br>T-1306 | T-148<br>T-1406 | T-18<br>T-106 | ¾<br>1 | ¾<br>1 | 4½<br>6 |
| T-140<br>T-403 | T-710<br>T-703 | T-1310 | T-1410 | T-110<br>T-103 | 1¼<br>5/8 | 1¼<br>1¼ | 6<br>7 |
| T-404 | T-704 | T-1304 | T-1404 | T-104 | ¾ | 1½ | 7 |

Vest pocket size 16-page instruction manual packed with each tool.

**Standard grades supplied with these tools: Grade 78B for steel cutting. For cast iron, brass, etc., grade 44A and (for longer tool life on rigid set-ups) grade 883.**

## FOR "UNIVERSAL" SHOP USE ON 80% OF ALL STEEL, CAST IRON, ETC., TURNING, BORING, FACING JOBS

**For fast delivery, maximum economy, easy ordering and simplified stocks, specify the new, recently announced Carboloy Standard Tools.**

**Just five styles—in three grades—are designed for universal use on 80% of all turning, boring and facing jobs on steel, cast iron, brass, etc. Rapid grinding procedure permits grinding innumerable variations in each tool. Proper carbide grade selection—often a problem—is practically automatic with these new standards. One grade for steel cutting; two for cast iron, brass, etc.**

**Take advantage of the new economies and broader uses now possible with Carboloy Tools through these simplified design and grade selection features and the new low prices (approaching the price of ordinary tools). Write for Catalog GT-125.**

The Mark of CARBOLOY

**Look for this triangular trade mark on tools you buy. It is your assurance of genuine Carboloy cemented carbide.**

**CARBOLOY COMPANY, INC., 11149 E. 8 MILE BLVD., DETROIT, MICHIGAN**

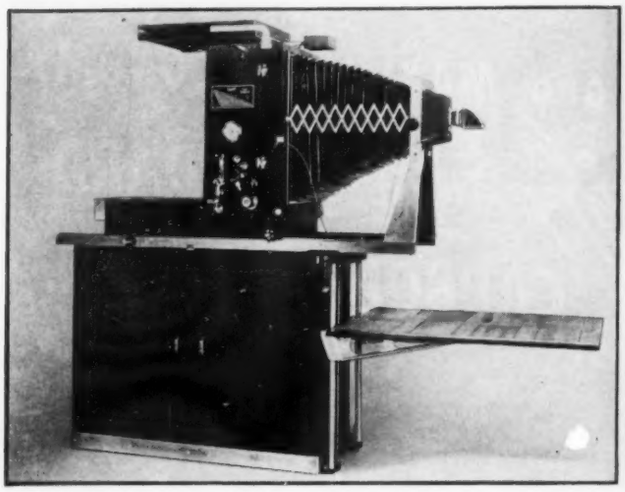
**Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Worcester, Mass.**

# CARBOLOY

REG U S PAT OFF

**TUNGSTEN CARBIDE—TANTALUM CARBIDE—TITANIUM CARBIDE**

**FOR CUTTING, DRAWING, SHAPING, EXTRUDING METALS AND NON-METALLICS ★ FOR REDUCING WEAR ON EQUIPMENT OR PRODUCTS YOU USE OR MAKE**



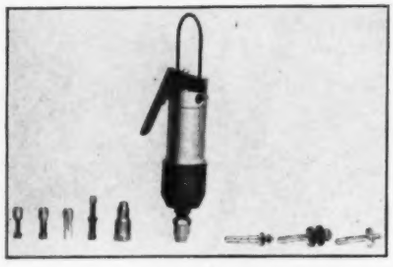
## "Rectigraph" Copying Unit Is Self-Contained Machine

The improved "Rectigraph" photocopying machine, designed to copy exactly by photography anything written, printed or drawn in actual, reduced, or enlarged size, comprises a complete machine which photographs, develops and fixes the print in the unit itself. Built by Haloid Co., Rochester, N. Y., this machine is said to employ exclusive features to facilitate rapid and economical copying for all types of work.

## Neoprene Coated Gloves Offered by Miller Rubber

A line of Neoprene coated canvas work gloves in both knit wrist and gauntlet types have been announced by Miller Rubber Co., Akron, Ohio.

These gloves resist oils, fats and greases and assure complete hand protection in practically all work where gloves are used. They offer all the hand comfort and finger freedom characteristic of canvas gloves, while the Neoprene coating gives them a tough wearing surface and considerably increases their service life. The knit wrist glove is wrist length, while the gauntlet type is 14½ in. long, including a 6-in. gauntlet.



## Ingersoll-Rand Develops "Baby" Air Grinder

A "baby" air grinder has been added to the line of pneumatic tools made by Ingersoll-Rand Co., Phillipsburg, N. J. This tool, called the Size 00, weighs only 1¼ lb. and operates at 20,000 r.p.m. at 90 lb. pressure. It is built to take 1½ in. diameter organic bonded or 1¼ in. diameter vitrified grinding wheels.

Available are various sizes of collets to take mandrel-mounted grinding wheels or small twist drills. Although originally intended to be used as a die grinder for toolroom and bench work, it is useful for light grinding jobs wherever metal must be removed from places that would otherwise be hard to reach.

## Improved Lamp Starter Made by Hygrade Sylvania

Hygrade Sylvania Corp., Salem, Mass., has developed an improved fluorescent lamp starter, available in three sizes. "Mirastat" No. 2 is for 14 and 20 watt fluorescent lamps, No. 4 is for 30 and 40 watt lamps, and No. 6 is for 100 watt lamps.

Improvements claimed for this starter include elimination of "sputtering," reduced blackening at the end of lamps; longer lamp life, and accurately timed starting. Power consumed is only ¼ watt.

## Boyer Campbell Offers New Face Protectors

Boyer Campbell Co., 6540 Antoine St., Detroit, Mich., has announced two improvements in face protection for industrial workers. The first comprises a welding helmet from which the glass can be removed and inserted from the outside in a few seconds, with a headband which may be adjusted on the head without removing gloves. The second is a low-priced face shield with a plastic window which is said to provide greater flexibility of adjustment without losing its shape. Both 4 x 9 and 6 x 9 window sizes of this No. 66 face shield are available.

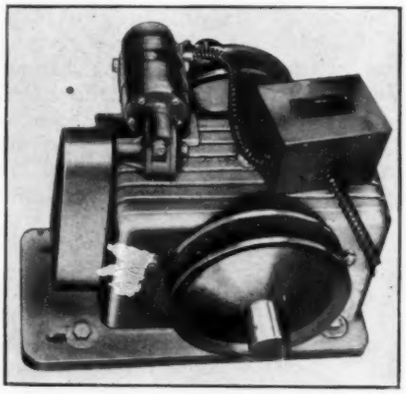
## Post Drafting Tables Are Easily Adjustable

Easy adjustment is an outstanding feature of the "Primo Metapost" and "Metapost" drafting tables built by Frederick Post Co., P. O. Box 803, Chicago, Ill. Working surfaces of these tables are adjustable from 35½ to 43 in., merely with the turn of a hand wheel in the case of the former model and by operation of two thumb screws with the latter. Table tops of both models may be tilted forward or backward to a 60-deg. angle.

These tables are available in eleven sizes, ranging from 31 x 42 in. to 48 x 96 in. Reference shelves are provided on all models.

## "Select-O-Speed" Drive Made With Remote Control

Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill., has developed a series of "Select-O-Speed" transmissions equipped with electric motorized control. These models supplement the standard line—from fractional to 7½-hp. capacity equipped with lever and handwheel control. Electric



control is especially recommended where the drive must be mounted on the ceiling, back of, or inside the equipment.

A two-button switch controls the speed. Changes in speed are easily made simply by pushing and holding either the fast or slow button until the desired speed is obtained.

## Rockwood Fiber Rolls Built in Many Sizes

Improved fiber rolls varying from 1½ to 24 in. in diameter and with faces up to 4 ft. wide are offered by Rockwood Mfg. Co., 1801–2001 English Ave., Indianapolis, Ind. In rolls up to about 5-in. diameter and 9-in. width, an improved type of construction provides a tough, rugged hub and spider of zinc

alloy cast under high pressure into the body of the fiber.

With this type of integral-cast construction, quantities of rolls or pulleys can be made at less expense than for other construction or material. It is claimed that improved machine performance is also achieved.

*(advertisement)*

## Manufacturers Look to Steel Warehouses for Quick Defense Requirements

Many leading manufacturers are relying on nearby steel-service plants for prompt, stock shipment of steel to meet the current surge of business prompted by Washington's defense program.

Probably the leading exponent of "Immediate Steel" is Ryerson with a network of ten strategically-located plants each of which has large and complete stocks of steel and allied products. In addition, each plant is equipped with complete forming and cutting facilities so steel can be prepared to customers' exact requirements. No shop should be without the Ryerson Stock List (see advertisement below).

Thousands of manufacturers report saving considerable time, trouble and money by taking advantage of Ryerson's complete flame cutting service. Modern equipment manned by specially trained operators can quickly burn any shape—no matter how intricate—from carbon or alloy steel plates and billets up to 15" thick.

EVERYTHING IN STEEL

Ryerson carries the largest and most complete steel stocks in America . . . carbon steels, alloys, stainless, etc., in every size, shape and form . . . a ready, reliable source of supply.

CERTIFIED QUALITY

Ryerson Certified uniform high quality Steels meet exacting, narrow range specifications . . . an important advantage—especially with alloy steels where chemical content, heat-treating response and other characteristics must be known with certainty to assure best results in less time.

IMMEDIATE SHIPMENT

Fast delivery is assured from ten conveniently located Ryerson plants . . . no order too small for prompt, personal attention or too large for immediate shipment.

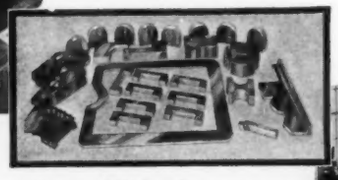
RYERSON CERTIFIED STEELS

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Buffalo, Cleveland, Boston, Philadelphia, Jersey City.

RYERSON

# DoAll STEPS UP PRODUCTION

At the Ingersoll Milling Machine Company, Rockford, Ill., discs for bearing retainers are made from 3140 flat steel on a DoAll in 30 minutes each. Outside diameter is 12", inside 9". A DoAll automatic circle cutting attachment is used.



*Other special parts made on the DoAll by Ingersoll include a target gauge in 15 minutes, 2 rocker arms in 12 minutes, head stops in 1 hour each.*

## INDISPENSABLE IN DEFENSE WORK

The DoAll is the rugged machine tool that effects such sensational savings in time, labor and material. Takes the place of lathe work, milling and shaping in thousands of plants. Now used in 30 countries for cutting every kind of metal in automobile factories, arsenals, ship yards, aeroplane plants, machine shops, etc.

**CONTINENTAL BAND FILER**

Does continuous filing, which means faster, better, smoother filing on all materials from toughest high-carbon steel to soft brass, wood, etc. Available are 12 styles of file bands, 3/8" and 1/4" wide—flat, oval or half round. Ask for circular.

***SPEEDMASTER***

An important part of every DoAll Machine. Gives instant variable speed.

**A compact unit, also sold separately for use on any other machines requiring variable speed. Produces any speed, 6 to 1 ratio, by mere touch of handle.**

Let us send a factory trained man to your plant to show you what a DoAll can do and save for you.

***FREE—Handbook on Contour Machining, 158 pages of valuable metal working helps.***

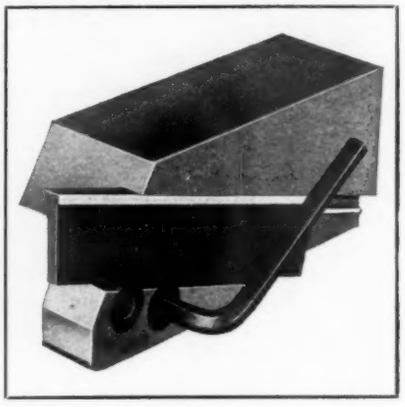
**CONTINENTAL MACHINES, INC.**

**1310 S. WASHINGTON AVE. MINNEAPOLIS, MINN.**


## Luers Cut-Off Tools Made by Empire Tool

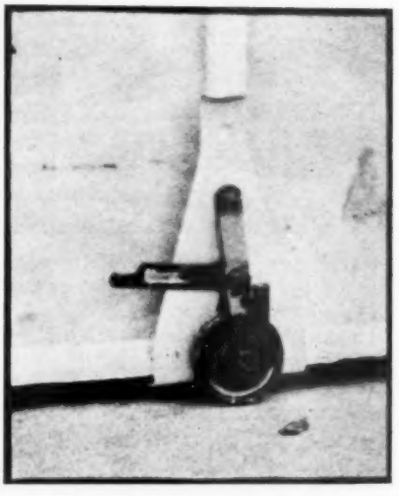
Empire Tool Co., 8790 Grinnel Ave., Detroit, Mich., has begun the manufacture of Luers cutting-off blades and holders under license from John Milton Luers Patents, Inc. These blades of patented design reduce friction to a minimum by providing both side and back clearance as well as producing a curved chip which frees itself from the side walls of the cut.

Blade is said to require sharpening on the front face only, saving sharpening time, removal and insertion time, and the time required to realign the blade in proper relationship to the work and other tools. Holders are available for every kind of hand and automatic screw machines.



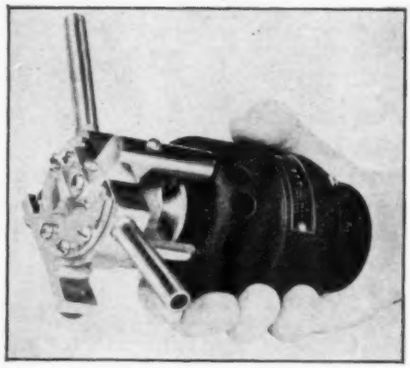
## Airtool "Travel Jacks" Move Heavy Objects

All types of moderately heavy crated objects and machinery bolted on skids can be easily moved with the "Travel Jacks" offered by Airtool Equipment Service, 110 S. Main St., South Bend, Ind. These jacks are easily applied to or removed from any crated load without special equipment.



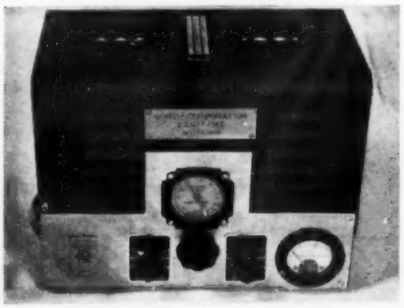
## Positive Pressure Pump Requires no Priming

No priming is required with the Model "UT" midget positive pressure pump developed by Eastern Engineering Co., 45 Fox St., New Haven, Conn. This compact high-pressure pump is said to be ideal for all applications in which the location of tanks and containers



makes a self-priming unit essential. Its light weight and small size make it particularly adaptable to all installations requiring pumping of thin liquid where weight and space must be kept to a minimum.

Maximum pressure with this pump is 35 lb. per sq. in. at a maximum volume of 3 gal. per min. Of the rotary type, the pump weighs 3½ lb. and occupies a space 6 x 3 x 2½ in. It is driven by a 1/20-hp. 115-volt universal motor.



## "Soren Varitime" Changes Synchronous Motor Speed

Speed of synchronous electric motors can be varied and tested with the "Soren Varitime" developed by Commonwealth Engineering Co. of Ohio, Dayton, Ohio. The unit is said to be particularly suitable for adjusting speed of small synchronous motors such as used for various types of cycle controls and timing systems.

The device provides an adjustable frequency from 18 to 240 cycles. It is housed in a sturdy steel cabinet, the 30-watt model weighing only 20 lb.


Yours for better Wiring

CROUSE-HINDS
CONDULETS
(CONDUIT FITTINGS)

When you're wiring the plant for uninterrupted production, remember that conduit fittings have an importance all out of proportion to their cost.

CONDULETS have been accepted as the top-quality line since 1906. They cut installation time, assure a rigid joint with permanent ground continuity.

Long-lasting is assured by three protective coats:

- Cast Feraloy
- Cadmium Plated
- Zinc Plated
- Aluminum Lacquered

Taper-Tapping, another outstanding CONDULET feature, assures that every thread on the conduit bears against every thread on the hub, extra assurance of metal to metal contact that won't loosen under vibration.

There are over 15,000 types of CONDULETS . . . one to meet every wiring requirement exactly.

THOMAS & BETTS
"WEDGE-ON"
CONNECTORS

These pressure (solderless) connectors will speed up installation on all types of electrical circuits, both in the plant and on equipment for resale.

"Wedge-On" Wire Splicers are particularly adapted to line, junction box, motor lead, outlet box and service entrance splices. For wire sizes from No. 16 through No. 4, and for combinations within that range.

"Wedge-On" Lugs are ideal for control wire installations and for use on terminal blocks. Wire is held under great pressure, with barrel supporting insulation so that vibration cannot break strands. Available for wire sizes No. 22 to No. 4, solid and stranded.

The T & B catalog of pressure connectors has 100 pages of these modern devices engineered especially for fast, firm connections of wire, cable, rod, tubing or bus bar. Write GRAYBAR for your copy.

GRAYBAR ELECTRIC COMPANY
In Over 80 Principal Cities
*Executive Offices:*
Graybar Building, New York, N. Y.

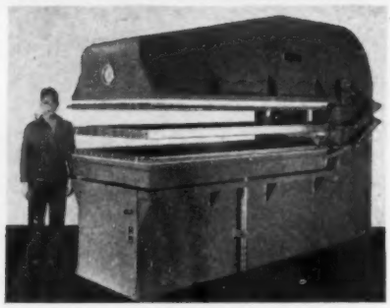
*Defense Note*
GRAYBAR offers action-service in emergencies on all types of electrical equipment and supplies.

Everything Electrical
GraybaR ELECTRIC COMPANY

SPEED UP YOUR WELDING OF HIGH STRENGTH—LOW ALLOYS WITH

MUREX

ELECTRODES



*Welded machine frame built by Farrell-Birmingham, Ansonia, Conn.*

SPECIALLY DESIGNED FOR CARBON-MOLY, COR-TEN, MAYARI, CROMANSIL, 2%-3% NICKEL AND OTHER STEELS

The Murex line includes a group of specially developed rods designed to produce welds with tensile strengths ranging from 70,000 to 100,000 lbs. per sq. in.; ductilities of 20% to 30% and corrosion and heat resisting qualities matching closely any of the more widely used new steels. Because of their excellent deposition rates at high amperages, their ease of handling by skilled welders, and the assurance they provide of cleaner, smoother deposits they step up welding speeds and help hold down costs.

Ask to have Murex Electrodes demonstrated on your high strength—low alloy applications. A note to the nearest M & T office will bring a representative promptly.

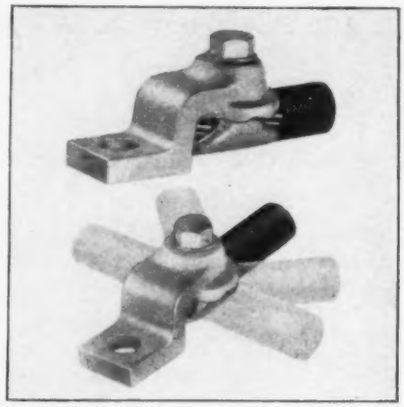
METAL & THERMIT CORPORATION
120 Broadway, New York, N. Y.

Albany • Chicago • Cincinnati
Detroit • Minneapolis • Pittsburgh
So. San Francisco • Toronto

MUREX
HEAVY COATED
Electrodes
A COMPLETE LINE FOR EVERY WELDING APPLICATION

## Connections Simplified With Burndy "Versilug"

A rotatable cable clamp is featured in the Type EA "Versilug" cable connector, developed by Burndy Engineering Co., 459 E. 133rd St., New York, N. Y. With this device, conductors can be joined to the connectors at any angle. Each size accommodates a wide range of conductors, and only six sizes are necessary to take conductors from



No. 8 stranded cable to conductors of 1,000 cm. The conductor body is made of high conductivity copper alloy, while clamping eye is made of high-strength bronze. There are no exposed threads.

## Improved Blueprint Cabinet Built by All-Steel Equip

Extreme flexibility of arrangement to meet the filing requirements of any drafting room is provided in the line of improved blue print filing cabinets developed by All-Steel Equip Co., Aurora, Ill. These units, available in three-drawer and five-drawer units, in four sizes, are claimed to operate so easily that even fully loaded drawers may be opened or closed easily by using only one handle. Smallest size cabinet is for drawings 24 x 18 in. Largest is for blueprints measuring 48 x 36 in. All units are finished in durable olive green baked on enamel.

## "Murex" Covered Electrodes Used on Alternating Current

Metal & Thermit Corp., 120 Broadway, New York, N. Y., has announced an addition to its line of "Murex" covered electrodes for manual arc welding. The new electrode, known as "Alternex," is designed especially for use with transformer type a.c. welding equipment. It is said to handle extremely well in all positions, including vertical down-welding. In the smaller sizes, it may also be used to advantage in welding light-gage steel.

# NEW MATERIALS

## Heat Resistant White Protects Many Metals

Watson-Standard Co., 225 Galveston Ave., Pittsburgh, Pa., has developed a heat-resistant white coating for protection of metal objects which are in use at temperatures up to 500 F. This material is claimed to hold its color and to have exceptionally long life at these elevated temperatures. It can be applied either by roller coating or by spray. It is subsequently baked, preferably at a temperature of about 325 F. for approximately 20 min.

## "Coprene" Synthetic Enamel Dries Hard in 24 Hours

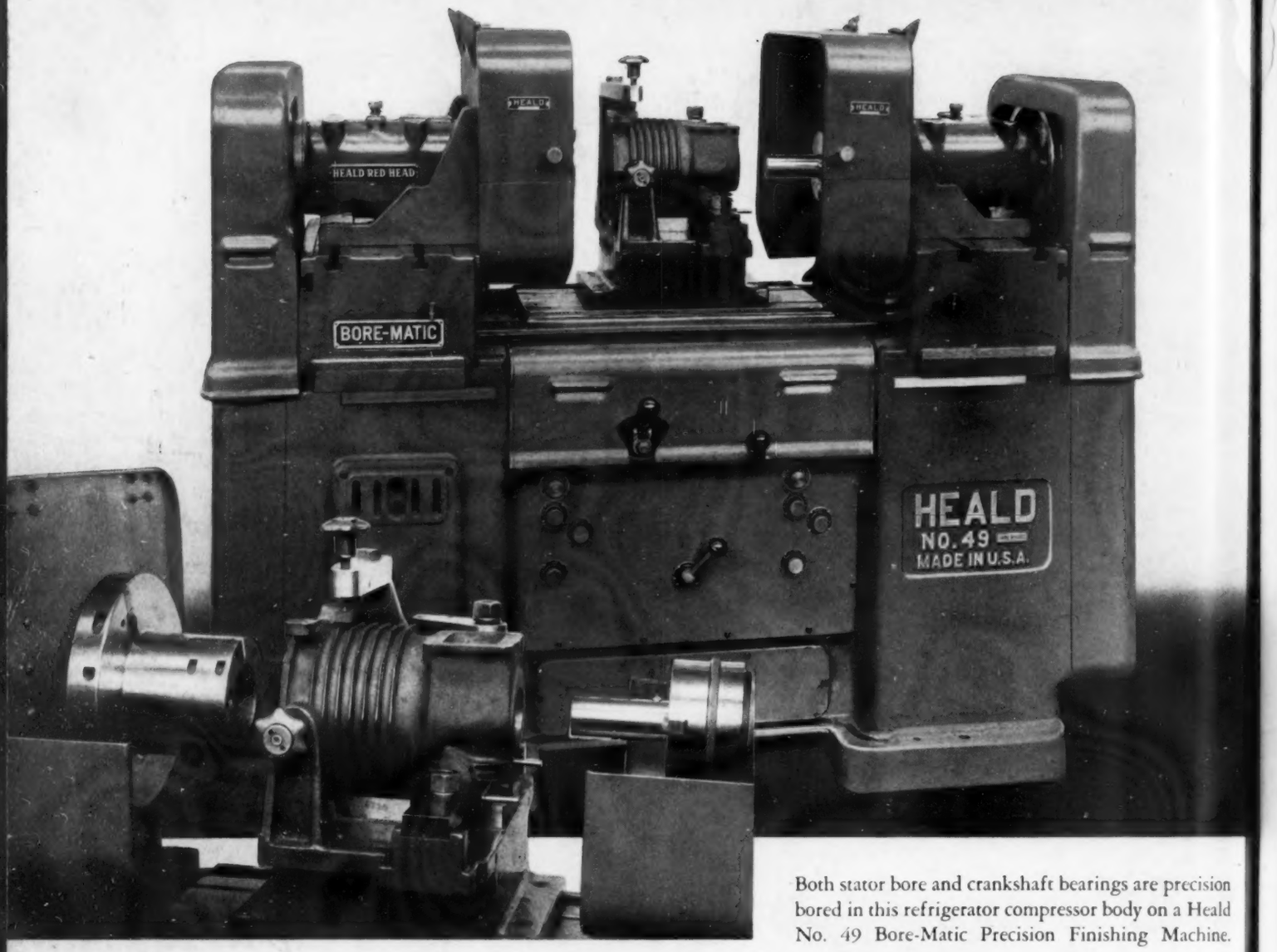
A line of synthetic enamels which air-dry so hard in 24 hours that they will not "paper print" has been announced by Maas & Walstein Co., 438 Riverside Ave., Newark, N. J. These finishes, known as "Coprene" enamels, have a chlorinated-rubber base. They air-dry dust-free in a few minutes and become hard overnight under normal conditions. Hardening is not merely a surface change, but extends throughout the entire coating, thus making it resistant to handling, wrapping, etc. Similar hardening can be obtained by force-drying for 1 hr. at 200 F.

"Coprene" enamels are supplied in clear, black, white and colors, and in silver, copper, and other metallic lustres. They are said to have good adhesion and good resistance to outdoor weather and household chemicals, and to retain their gloss, flexibility and color. They are suitable for use on all kinds of metal products.

# AMERICAN MACHINIST

## 28th ANNUAL BUYERS REFERENCE NUMBER


| | PAGE |
|---|---|
| Machine Tools | 73 |
| Tools and Accessories | 175 |
| Presses, Forging and Molding Machines | 237 |
| Welding, Heat-Treating, Cleaning and Finishing | 267 |
| Plant-Service Equipment | 297 |
| Parts and Materials | 333 |




Both stator bore and crankshaft bearings are precision bored in this refrigerator compressor body on a Heald No. 49 Bore-Matic Precision Finishing Machine.

# WHERE PRECISION AND PRODUCTION ARE FACTORS

Any manufacturer having mass production of similar parts and requiring exceptional accuracy such as are found in the Electric Refrigerator Industry will do well to check his methods and equipment to see that he is getting maximum results.

Today, precision boring, facing, turning, as well as many other operations, are being accomplished to best advantage on Heald Bore-Matics, machines especially built for precision finishing using a single pointed diamond or carbide tool.

In the above installation both the stator bore and the crankshaft bearings in refrigerator compressor bodies are completely finished on the No. 49 Double End Bore-Matic. Operations are carried out in three setups. In the first setup the stator bore is semi-finish bored, a bushing seat is semi-finish and finish bored and faced, and a seat for a bearing cap is semi-finish bored. In the second setup the stator bore is finish bored and faced on the outer face, a bronze bushing previously inserted is faced and the bore for the bearing cap is finished and also faced. Finally, the bearing cap is attached and the two bronze bushings for the crankshaft bearings are finish bored in the last setup.

A complete line of Bore-Matics makes possible the selection of just the machine for your work. Complete information on request. No obligation.

**The HEALD Machine Company**

WORCESTER, MASSACHUSETTS, U. S. A.